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Small Takes of Marine Mammals Incidental to Specified Activities; Marine Seismic Survey on the Blanco Fracture Zone in the Northeastern Pacific Ocean; Notice

DEPARTMENT OF COMMERCE

National Oceanic and Atmospheric Administration

[I.D. 031104B]

Small Takes of Marine Mammals Incidental to Specified Activities; Marine Seismic Survey on the Blanco Fracture Zone in the Northeastern Pacific Ocean

AGENCY: National Marine Fisheries Service (NMFS), National Oceanic and Atmospheric Administration (NOAA), Commerce.

ACTION: Notice of issuance of an incidental harassment authorization.

SUMMARY: In accordance with provisions of the Marine Mammal Protection Act (MMPA) as amended, notification is hereby given that an Incidental Harassment Authorization (IHA) to take small numbers of marine mammals, by harassment, incidental to conducting oceanographic seismic surveys on the Blanco Fracture and Gorda Ridge zones in the Northeastern Pacific Ocean has been issued to Lamont-Doherty Earth Observatory (L-DEO).

DATES: Effective from October 20, 2004 through October 19, 2005.

ADDRESSES: The application, IHA and a list of the references used in this document are available by writing to Steve Leathery, Chief, Permits, Conservation and Education Division, Office of Protected Resources, National Marine Fisheries Service, 1315 East-West Highway, Silver Spring, MD 20910–3225, or by telephoning the contact listed here. A copy of the application is also available at: *http://www.nmfs.noaa.gov/prot__res/PR2/Small__Take/smalltake__info.htm#applications*

FOR FURTHER INFORMATION CONTACT: Kenneth Hollingshead, Office of Protected Resources, NMFS, (301) 713–2322, ext 128.

SUPPLEMENTARY INFORMATION:

Background

Sections 101(a)(5)(A) and (D) of the MMPA (16 U.S.C. 1361 *et seq.*) direct the Secretary of Commerce to allow, upon request, the incidental, but not intentional, taking of marine mammals by U.S. citizens who engage in a specified activity (other than commercial fishing) within a specified geographical region if certain findings are made and either regulations are issued or, if the taking is limited to harassment, a notice of a proposed authorization is provided to the public for review.

Permission may be granted if NMFS finds that the taking will have a negligible impact on the species or stock(s) and will not have an unmitigable adverse impact on the availability of the species or stock(s) for subsistence uses and that the permissible methods of taking and requirements pertaining to the monitoring and reporting of such takings are set forth. NMFS has defined ‘‘negligible impact’’ in 50 CFR 216.103 as ’’...an impact resulting from the specified activity that cannot be reasonably expected to, and is not reasonably likely to, adversely affect the species or stock through effects on annual rates of recruitment or survival.’’

Section 101(a)(5)(D) of the MMPA established an expedited process by which citizens of the United States can apply for an authorization to incidentally take small numbers of marine mammals by harassment. Except for certain categories of activities not pertinent here, the MMPA defines ‘‘harassment’’ as:

> any act of pursuit, torment, or annoyance which (i) has the potential to injure a marine mammal or marine mammal stock in the wild [Level A harassment]; or (ii) has the potential to disturb a marine mammal or marine mammal stock in the wild by causing disruption of behavioral patterns, including, but not limited to, migration, breathing, nursing, breeding, feeding, or sheltering [Level B harassment].

Section 101(a)(5)(D) establishes a 45–day time limit for NMFS review of an application followed by a 30–day public notice and comment period on any proposed authorizations for the incidental harassment of marine mammals. Within 45 days of the close of the comment period, NMFS must either issue or deny issuance of the authorization.

Summary of Request

On March 8, 2004, NMFS received an application from L-DEO for the taking, by harassment, of several species of marine mammals incidental to conducting a seismic survey program. L-DEO plans to conduct a marine seismic survey in the Northeastern Pacific Ocean (NPO), off Oregon, during the fall of 2004. Up to two seismic surveys are scheduled to take place in the NPO. The main survey is planned to occur near the intersection of the Blanco Transform and the Juan de Fuca Ridge. Time permitting, a second survey may be conducted at Gorda Ridge. The main seismic survey will take place between 44°0 20′ and 44° 42′N and between 129° 50′ and 130° 30′W or at least 450 km (243 nm) offshore and outside the Exclusive Economic Zone (EEZ) of any nation. The Gorda Ridge survey is located between 42° 20′ and 43° N and between 126° 30′ and 127° W, at least 84 nm (155.6 km) offshore, but within the EEZ of the United States.

The purpose of the seismic survey is to obtain information on the structure of the oceanic crust created at the Juan de Fuca Ridge. More specifically, the survey will obtain information on the geologic nature of boundaries of the earth’s crust created at the intermediate-spreading Juan de Fuca Ridge. Past studies have mapped those boundaries using manned submersibles, but they have not provided a link between geologic and seismic structure. This study will provide the seismic data to assess the geologic nature of the previously mapped areas.

Description of the Activity

The proposed seismic survey will involve one vessel, the *R/V Maurice Ewing* (*Ewing*). The *Ewing* will deploy a 10– or 12–airgun array as an energy source, with discharge volumes of 3050 in^3 and 3705 in^3, respectively. The *Ewing* will also deploy and retrieve 12 Ocean Bottom Seismometers (OBSs), plus tow a 6–km (3.2 nm) streamer containing hydrophones, to receive the returning acoustic signals. As the airguns are towed along the survey lines, these two systems will receive the returning acoustic signals.

A total of approximately 150 kilometers (km) (81 nautical miles (nm)) of OBS surveys using a 12–gun array (24 hours of operation) and approximately 1017 km (549 nm) of Multi-Channel Seismic (MCS) profiles using a 10–gun array (6.5 days of operation) are planned to be conducted during the main survey. These line-kilometer figures include operations associated with start up, line changes of 10 km (5 nm) for the 12–gun array and 90 km (49 nm) for the 10–gun array, equipment testing, contingency profiles, and repeat coverage of any areas where initial data quality is sub-standard. In the unlikely event that there are no weather or equipment delays, additional MCS profiles may be acquired at the northern end of the Gorda Ridge where it intersects the Blanco Transform. The contingency survey would consist of 220 km (119 nm) of survey lines using the 10–gun seismic array, plus 63 km (34 nm) for turns and connecting lines, for a total of 283 km (153 nm). Water depths within the seismic survey areas are 1600 5000 m (5250 16,405 ft).

During the airgun operations, the vessel will travel at 7.4–9.3 km/hr (4–5 knots), and seismic pulses will be emitted at intervals of 60–90 sec for the OBS lines and approximately 20 sec for the Multi-Channel Seismic profiles

(MCS lines). The 20–sec spacing corresponds to a shot interval of about 50 m (164 ft), while the 60–90 sec spacing corresponds to a distance of 150 m (492 ft) to 220 m (722 ft), respectively. The 60–90 sec spacing along OBS lines is to minimize reverberation from previous shot noise during OBS data acquisition, and the exact spacing will depend on water depth.

For the 10- and 12–airgun arrays, the sound pressure fields have been modeled by L-DEO in relation to distance and direction from the airguns, and in relation to depth. Predicted sound levels are depicted in Figures 6 and 7 in L-DEO's application. Empirical data concerning those sound levels have been acquired based on measurements during an acoustic verification study conducted by L-DEO in the northern Gulf of Mexico from 27 May to 3 June 2003. L-DEO's analysis of the acoustic data from that study (Tolstoy *et al.* 2004) provides limited measurements in deep water, such as found at Blanco Fracture and Gorda Ridge. Those data indicate that, for deep water, L-DEO's model tends to overestimate the received sound levels at a given distance. NMFS and L-DEO, therefore, propose that the 180–dB and 190–dB (re 1 microPascal (root-mean-squared (rms)) sound pressure fields that will correspond to the safety radii (see Mitigation) will be the values predicted by L-DEO's model during airgun operations in deep water, including these planned survey operations.

For the Blanco Fracture survey using 10–gun and 12–gun arrays, the distances at which seismic pulses are expected to diminish to received levels of 190 dB, 180 dB, 170 dB and 160 dB re 1 microPa rms are as follows:

TABLE 1. DISTANCES TO WHICH SOUND LEVELS MIGHT BE RECEIVED FROM THE AIRGUN ARRAYS PLANNED FOR USE IN THE BLANCO FRACTURE ZONE.

Airgun Array	RMS Radii (m/ft)			
	190 dB	*180 dB*	*170 dB*	*160 dB*
1 airgun	13/43	36/118	110/361	350/1148
10 airguns	200/656	550/1805	2000/6562	6500/21325
12 airguns	250/820	600/1968	2200/1718	7250/23786

Additional information is contained in the L-DEO application, especially in Appendix A.

In addition to the operations of the airgun array, the ocean floor will be mapped continuously throughout the entire cruise with an Atlas Hydrosweep DS–2 Multibeam 15.5–kHz bathymetric sonar, and a 3.5–kHz sub-bottom profiler. Both of these sound sources are commonly operated simultaneously with the airgun array, but may, on occasion, be utilized independent of the seismic array.

The Atlas Hydrosweep is mounted on the hull of the *Maurice Ewing*, and it operates in three modes, depending on the water depth. There is one shallow water mode and two deep-water modes: an Omni mode and a Rotational Directional Transmission (RDT) mode. The RDT mode is normally used during deep-water operation and has a 237–dB rms source output. In the RDT mode, each ''ping'' consists of five successive transmissions, each ensonifying a beam that extends 2.67 degrees fore-aft and approximately 30 degrees in the cross-track direction. The five successive transmissions (segments) sweep from port to starboard with minor overlap, spanning an overall cross-track angular extent of about 140 degrees, with small (<1 millisec) gaps between the pulses for successive 30–degree segments. The total duration of the ''ping,'' including all five successive segments, varies with water depth, but is 1 millisec in water depths less than 500 m and 10 millisec in the deepest water. For each segment, ping duration is 1/5th of these values or 2/5th for a receiver in the overlap area ensonified by two beam segments. The ''ping'' interval during RDT operations depends on water depth and varies from once per second in less than 500 m (1640.5 ft) water depth to once per 15 seconds in the deepest water.

The sub-bottom profiler is normally operated to provide information about the sedimentary features and the bottom topography that is simultaneously being mapped by the Hydrosweep. The energy from the sub-bottom profiler is directed downward by a 3.5 kHz transducer mounted in the hull of the *Ewing*. The output varies with water depth from 50 watts in shallow water to 800 watts in deep water. Pulse duration is 1, 2 or 4 ms and the pulse interval is 1 second (s) but a common mode of operation is to broadcast five pulses at 1–s intervals followed by a 5–s pause. The beamwidth is approximately 30° and is directed downward. Maximum source output is 204 dB re 1 microPa, 800 watts, while nominal source output is 200 dB re 1 microPa, 500 watts. Pulse duration will be 4, 2, or 1 ms, and the bandwith of pulses will be 1.0 kHz, 0.5 kHz, or 0.25 kHz, respectively.

Sound levels have not been measured directly for the sub-bottom profiler used by the *Ewing*, but Burgess and Lawson (2000) measured sounds propagating more or less horizontally from a similar unit with similar source output (205 dB re 1 microPa m). The 160 and 180 dB re 1 microPa rms radii in the horizontal direction were estimated to be, respectively, near 20 m (66 ft) and 8 m (26 ft) from the source, as measured in 13 m or 43 ft water depth. The corresponding distances for an animal in the beam below the transducer would be greater, on the order of 180 m (591 ft) and 18 m (59 ft), assuming spherical spreading.

The sub-bottom profiler on the *Ewing* has a stated maximum source level of 204 dB re 1 microPa. Thus the received level would be expected to decrease to 160 and 180 dB about 160 m (525 ft) and 16 m (52 ft) below the transducer, respectively, assuming spherical spreading. Corresponding distances in the horizontal plane would be lower, given the directionality of this source (30° beamwidth) and the measurements of Burgess and Lawson (2000).

Characteristics of Airgun Pulses

Discussion of the characteristics of airgun pulses was provided in the notice of proposed authorization to L-DEO for this activity (69 FR 31792, June 7, 2004) and is not repeated here. Reviewers are encouraged to read this earlier document for information on how airgun arrays function.

Comments and Responses

A notice of receipt and request for public comment on the application and proposed authorization was published on June 7, 2004 (69 FR 31792). During the 30–day public comment period, comments were received from the Center for Biological Diversity (CBD), the Natural Resources Defense Council (NRDC), the New York Whale and Dolphin Action League (NYWDAA), the Animal Welfare Institute (AWI), and one individual member of the public. In addition, NMFS received approximately 300 e-comments on this proposed action. These comments did not raise additional significant issues on the proposed authorization that are not also addressed by the commenters mentioned here.

Marine Mammal Concerns (MMC)

Comment MMC 1: The CBD states the notice and application do not have sufficient data to support the conclusion that only small numbers (of marine mammals) will be taken. For many species, NMFS is relying on incomplete, outdated, or no surveys whatsoever. For example, there is no information provided at all for Blainville's, Hubb's, and Stejneger's beaked whales, California sea lion, Steller sea lion, or harbor seal. Surveys should be conducted prior to authorizing the IHA.

Response: NMFS does not agree that marine mammal assessment surveys are needed prior to issuing an IHA. When information is unavailable on a local marine mammal population size, NMFS uses either stock or species information on abundance. Therefore, additional surveys are unnecessary. Also, while information may be lacking for some species of beaked whales, information on pinniped abundance and trends is found in the application.

Comment MMC 2: The CBD believes that NMFS' analyses of small numbers and negligible impact are flawed. First, NMFS uses ''North Pacific Ocean'' to define the geographical limits of the ''regional'' populations that form the basis of its analyses instead of providing an analysis of impacts on stocks or more localized populations that overlap with the project area. The CBD believes that the appropriate geographic scale should be populations and stocks inhabiting the survey area and not the entire North Pacific. Similarly, the NRDC believes that L-DEO uses the population size for humpback whales for the entire North Pacific (6000 animals) rather than on the lower estimates produced for the U.S. West Coast or the defined feeding area off Oregon and Washington coasts (between 300 and 1400).

Response: NMFS agrees that impacts should be assessed on the population or stock unit whenever possible. L-DEO's application (see especially Table 2 in the application) provides information on stock abundance in Oregon/Washington (when available) and larger water bodies (such as the North Pacific Ocean). The data source for each stock estimate is provided. NMFS believes that these data are the best scientific information available for estimating impacts on marine mammal species and stocks. However, Congress recognized that information on marine mammal stock abundance may not always be satisfactory. When information is lacking to define a particular population or stock of marine mammals then impacts are to be assessed with respect to the species as a whole (54 FR 40338, September 29, 1989). Table 2 in this **Federal Register** document provides the percentage of the regional population of each species of marine mammal (when known) estimated to be exposed to SPLs at or greater than 160 dB (rms).

When estimating take levels for humpback whales, L-DEO calculated humpback whale density using the 1996 and 2001 marine mammal ship survey data for waters off Washington and Oregon found in Barlow (2003). This estimate is based on nine humpback whale sightings during 7482 km (4044 nm) of survey effort during both years. The final density estimate found in Table 3 in the L-DEO application of 0.0005/sq km is the weighted average (based on effort in each year) of the densities reported in Barlow (2003) for the 1996 and 2001 surveys.

Comment MMC 3: The NRDC argues that the numbers used by L-DEO for killer whale abundance estimates fail to capture the distinctions made in the literature among the various resident and transient stocks in the Pacific Northwest. One citizen believes that the management unit for NMFS is the stock, not the species and that while the estimated impacts may be small relative to population size of the species, they may not be small relative to the affected stock. For example, one commenter states the proposed study site is used by the Eastern North Pacific (ENP) Resident Stock of killer whales. It numbers fewer than 85 individuals. It rarely travels in units of fewer than 20 individuals, so if present in the study area at all, at least 25 percent of the population would be affected. Since the stock is already depleted, a lethal taking of this magnitude would be devastating. The potential is obscured by including members of other stocks in the population estimate for killer whales. The CBD believes that the appropriate geographical scale is particularly critical for the killer whale, such as the ENP Transient, ENP Offshore, and the Northern and Southern Resident stocks. NMFS does not even mention the impacts of the proposed authorization on these stocks of killer whales in the proposed authorization, rendering the analysis wholly useless. The take of even one killer whale from these stocks will have more than a negligible impact on the stock and the species.

Response: Information on the killer whale stocks can be found in Angliss and Lodge (2003), particularly on the ENP Northern Resident and Transient stocks, and in Caretta et al. (2003), particularly on the ENP Offshore and Southern Resident stocks. Information was provided in L-DEO's application and in NMFS' proposed authorization notice (see text and Table 2).

Based on summer/fall shipboard line-transect surveys in 1996 (Barlow, 1997) and 2001 (Barlow, 2003) the total number of killer whales within 300 nm (556 km) of the coasts of California, Oregon and Washington has been estimated to be 1340 (CV=0.31). Caretta *et al.* (2003) note the while there is currently no way to reliably distinguish the different stocks of killer whales from sightings at sea they estimate that, by prorating (as explained in Caretta *et al.*, 2003) there are 466 offshore killer whales along the U.S. West Coast with a Pmin of 361 animals. Because of the location of the Blanco Fracture survey, NMFS believes that Level B harassment would be limited to the ENP Offshore stock of killer whales.

Since this species is unlikely to be in the vicinity of the *Ewing* at the time seismic is operating (L-DEO, 2004), and would be highly visible to observers if it was present, no killer whales will be injured or killed (i.e., no removals from the species or stock) as a result of the *Ewing*'s seismic operations. Therefore, the only potential taking might be by Level B harassment. As indicated in Table 2 in this document, L-DEO estimates that approximately 12 killer whales might be within the 160–dB (rms) isopleth and, therefore, presumed to be harassed. This is less than 0.1 percent of the regional killer whale population and less than 0.3 percent of the regional offshore population.

Moreover, since the killer whale's optimum hearing range is not in the low frequency used by seismic sources, this number should not be interpreted as the number being ''taken'' by Level B harassment, only the number that might be exposed to that level of noise. Therefore, it is highly unlikely that the taking by Level B harassment will be more than negligible on the offshore killer whale stock.

Comment MMC 4: The NRDC states that L-DEO appears to be relying on survey data that are quite limited and, for some species, may be misleading. For Cuvier's beaked whales, a species now thought to be extremely vulnerable to intense noise, the abundance estimate provided by L-DEO and adopted by NMFS is zero, based presumably on a lack of sightings of these animals during the 1996 and 2001 surveys by the

Southwest Fisheries Science Center. It has recently been observed, however, that the likelihood of sighting beaked whales in anything heavier than a light breeze is minimal. If the 1996 and 2001 surveys were mainly conducted in rougher weather, then the density of these animals at the Blanco and Gorda sites may be higher than supposed.

Response: Caretta *et al.* (2004) determined that a multi-year average abundance estimate for Cuvier's beaked whales along the coasts of California, Oregon and Washington is the most appropriate estimate for management purposes on the U.S. West Coast because this species probably spends time outside the U.S. EEZ. The 1996–2001 weighted average abundance estimate is 1884 (CV=0.68) and the minimum population size is 1121 animals. No marine mammal assessment surveys have been conducted off Oregon and Washington so there is not a population estimate for these states separate from California. That was the reason for Table 2 in L-DEO's application indicating zero Cuvier's beaked whales off Oregon and Washington. The population estimate of 1884, as shown in Table 2 of L-DEO's application, has been accepted by NMFS as the best scientific information available for the stock size for Cuvier's beaked whale along the Pacific coast of the United States.

There is a scientific methodology to estimate the probability of detecting marine mammals during vessel assessment surveys, as explained in detail in Buckland et al. (1993). NMFS marine mammal ship survey procedures are detailed in Barlow (1995). Methodology includes several components, including the probability that the mammal will be at the surface and potentially sightable while within visual range of the observers, the probability that an animal at the surface will in fact be detected, and the relationship between sighting probability and lateral distance from the ship's trackline. All of these factors are taken into account when making density and population abundance estimates. Finally, Barlow (1995) notes that because small whales and ''cryptic'' marine mammal species were seldom seen in rough conditions, the abundance estimate for these species were made using only data from calm conditions (see also Barlow, 2003).

Comment MMC 5: The AWI states that combining the ramifications of studies and statements cited in its letter(Jepsen, 2003; Taylor *et al.*, 2004; Mead, 2000; Simmonds and Lopez-Jurado, 1991; Martin-Martel, 2003; and Frantzis, 1998), a highly plausible new mechanism for injury emerges that must be considered by NMFS in all applications requesting permission to take marine mammals incidental to emission of intense sounds into the ocean, especially, but not exclusively when beaked whales are known to live in the area. This mechanism appears to be an acute behavioral response to relatively low (100–160 dB) levels of sound, which may lead to death.

Response: A review of the Smithsonian stranding database by Mead (2000) shows that there had been seven instances of multiple beaked whale strandings up to that date. One of these instances involved ordnance, two were not associated with military activities, and four were concurrent with military maneuvers. (Taylor *et al.* (2004) recently updated this list.) It is not known whether sonar was involved with these naval exercises (NOAA, 2002). Simmonds and Lopez-Jurado (1991) state that between 1982 and 1989 there were 22 strandings of cetaceans in the Canary Islands, with three being related to military activity. The Simmonds and Lopez-Jurado (1991) and Frantzis (1998) articles were published scientific correspondences based solely on observations. The Jepsen *et al.* (2003) paper, which discussed the September, 2002 multi-species stranding in the Canary Islands, is analyzed in a later response.

Prior to the 2000 Bahamas stranding (see DON and NOAA, 2001), no tissues were collected, and the type of military maneuvers and time and distance separating them from the animals' original location are not known. Without this information NMFS cannot conclude whether sonar did or did not cause these deaths. Therefore, the data do not necessarily suggest a high correlation between naval activities and beaked whale strandings, nor do they provide evidence of causation. It should also be noted that the implicated sonar in the 2000 Bahamas stranding incident was a mid-frequency sonar (2.6 and 3.3 kHz), not the low frequency (0–188 Hz) seismic airguns found on the *Ewing*. In addition, as for reasons noted in response to comment MMC 8, the other acoustic equipment onboard the *Ewing* (the Atlas Hydrosweep DS–2 Multibeam 15.5–kHz bathymetric sonar and the 3.5–kHz sub-bottom profiler) are not likely to be capable of causing marine mammal strandings because of their brief pings.

After the 2000 Bahamas beaked whale stranding, two hypotheses were identified on a possible mechanism for the stranding event. The most widely discussed hypothesis was that the stranding may have resulted from air cavity resonance caused by exposure to mid-frequency active sonar, or to a source with similar operating characteristics. It was concluded that acoustic resonance in air-filled structures was not likely to have played a primary role in the Bahamas stranding (but could play a secondary role)(Gentry, R. 2002, available at *http://www.nmfs.noaa.gov/prot__res/readingrm/MMSURTASS/Res__Wkshp__Rpt__Fin.PDF)*.

A second hypothesis developed at the workshop considered as a possible cause of beaked whale strandings was the acoustic activation of nitrogen bubble nuclei in tissues that are supersaturated with nitrogen from respiratory gases after diving. Factors that support this hypothesis include: (1) Beaked whales are deep divers with slow descent and ascent rates that promote high degrees of supersaturation which, in theory, should increase their susceptibility to bubble growth, and (2) some trauma in the Bahamas animals was similar to that experienced by terrestrial animals subjected to rapid decompression. Factors that refute the hypothesis include: (1) the resonant frequency of microbubbles is much higher than either low- or mid-frequency sonars, and (2) deep-diving mammals that produce intense vocalizations would be expected to have evolved some bubble suppression mechanisms over time. The Gentry report states that less is known about acoustically mediated bubble activation than about any other hypothesized mechanisms for the strandings. Especially important is (1) determining whether marine mammals have bubbles at all when they dive, (2) the lowest SPL that can trigger bubble activation if it occurs, (3) modeling bubble onset (nucleation) and stabilization, and (4) modeling the role of acoustic waves in bubble growth under realistic levels of nitrogen supersaturation.

NMFS concluded that the scientific community needs more information before it can satisfactorily explain: (1) why most sonar operations apparently do not cause strandings, but some do, depending upon factors present, (2) which taxa are most, and which are least, susceptible to these sounds, (3) whether the differences between these groups suggest a plausible mechanism of effect, (4) whether there is some as yet unknown physiological effect of exposure much lower than those that cause trauma in laboratory animals, (5) whether animals respond behaviorally to sonar in ways that may increase their exposure, and (6) whether mid-frequency sonars affect populations of animals in ways they do not affect individuals (i.e. through socially facilitated panic). At the present time, NMFS believes that beaked whales are sometimes affected by mid-frequency sonar, but does not know the mechanism for that effect.

Only two papers, Taylor et al. (2004) and Engel et al. (2004) reference seismic signals as a possible cause for a marine mammal stranding. Taylor *et al.* (2004) noted two beaked whale stranding incidents related to the *Ewing*. Both of those stranding incidents were discussed in L-DEO's application. Additional discussion can be found in response to comment MMC7. However, in recognition of a possibility that seismic operations may be having this possible effect, NMFS is requiring additional mitigation measures as discussed later in this document (see Mitigation).

Engel *et al.* (2004), a recent paper presented to the International Whaling Commission (IWC) in 2004 (SC/56/E28), mentioned a possible link between oil and gas seismic activities and the stranding of 8 humpback whales (7 off the Bahia or Espirito Santo States and 1 off Rio de Janeiro, Brazil). Additional concerns about the relationship between this stranding event and seismic activity were raised by the International Association of Geophysical Contractors (IAGC). The IAGC (2004) argues that not enough evidence is presented in Engel *et al.* (2004) to assess whether or not the relatively high proportion of adult strandings in 2002 is anomalous. The IAGC contends that the data do not establish a clear record of what might be a ''natural'' adult stranding rate, nor is any attempt made to characterize other natural factors that may influence strandings. NMFS is concerned that the Engel *et al.* (2004) article appears to compare stranding rates made by opportunistic sightings in the past with organized aerial surveys beginning in 2001. If so, then the data are suspect.

Comment MMC 6: The AWI quotes portions of the Jepsen et al. (2003) paper that ''these lesions (found in the 14 beaked whales that stranded in the Canary Islands in 2002) are consistent with acute trauma due to *in vivo* bubble formation resulting from rapid decompression (as occurs in decompression sickness (DCS)). Bubble formation in response to sonar exposure might result from behavioral changes to normal dive profiles (such as accelerated ascent rate), causing excessive nitrogen supersaturation in the tissues (as occurs in decompression sickness); alternatively, bubble formation might result from a physical effect of sonar on *in vivo* bubble precursors (gas nuclei) in nitrogen-supersaturated tissues.''

Response: The hypothesis proposed by Jepsen *et al.* (2003) is considered by NMFS scientists and others to be speculative at this time. Piantadosi and Thalman (2004) consider the hypothesis to contain two flaws. First, whales do not develop sufficient gas supersaturation in the tissues on ascent to cause extensive bubble formation in the liver (i.e., Jepsen *et al.* (2003) found the livers of these animals to be the most consistently affected organ). Second, large gas-filled cavities in the liver are inconsistent with the pathology of DCS in humans and other mammals in which the bones, joints, lungs and central nervous system are primarily affected. They conclude that identifying the cetacean gas disease with DCS is, therefore, premature because its pathology not only differs from that underlying the syndrome in other mammals, but it also cannot be explained by any physiological mechanism related to diving. Fernandez *et al.* (2004) reply that even if naturally occurring levels of nitrogen supersaturation in the tissues of diving cetaceans are normally insufficient to initiate bubble growth, a theoretical possibility remains that cetaceans with supersaturated tissues could experience bubble growth or formation as a result of intense acoustic exposure. However, Fernndez *et al.* (2004) conclude that these uncertainties argue for caution in interpreting the limited studies available. Finally, all authors concur that further investigation is needed, including an analysis of the composition of the gas in the bubbles.

Comment MMC 7: The AWI states that, in light of the Taylor *et al.* (2004) paper, NMFS needs to reassess its statement that ''the evidence with respect to seismic surveys and beaked whale strandings is inconclusive and NMFS has not established a link between the Gulf of California stranding and the seismic activities.'' The AWI believes the authors document first-hand experience of beaked whale strandings that coincided exactly with a seismic survey being conducted by the *Ewing*.

Response: Taylor *et al.* (2004) does not refute NMFS' statement made in the proposed IHA notice. The statement in Taylor *et al.* (2004) was that the *Ewing* was firing its airguns at 1300 hrs on September 24 and that between 1400 and 1600 hrs, local fishermen found live-stranded beaked whales some 22 km (12 nm) from the ship's location. Review of the *Ewing*'s trackline indicates that the closest approach of the *Ewing* and the beaked whales stranding location was 18 nm (33 km) at 1430 hrs. At 1300 hrs, the *Ewing* was located 25 nm (46 km) from the stranding location. What is unknown is the location of the beaked whales prior to the stranding in relation to the *Ewing*, but the close timing of events indicates that the distance was not less than 18 nm (33 km). No physical evidence for a link between the seismic event and the stranding was obtained. In addition, Taylor *et al.* (2004) indicates that the *Ewing* was operating 500 km (270 nm) from the 2000 Galapagos Island stranding site. Whether the Ewing seismic survey caused to beaked whales to strand is a matter of considerable debate (Cox *et al.*, in review). NMFS believes that scientifically, these events do not constitute evidence that seismic surveys have an effect similar to that of mid-frequency sonar. However, these incidents do point to the need to look for such effects during future surveys. Follow-up surveys by the *Ewing* and other vessels are now required whenever time and tracklines permit doing so. To date, follow-up observations have not indicated any beaked whale stranding incidents (a marine mammal does not need to be on the beach in order for it to be considered a stranding).

Comment MMC 8: The AWI argues that given recent events, subsequent research, and expert discussion that support the contention that beaked whales may startle when ensonified by specific anthropogenic noises from seismic survey experiments and mid-range sonars, rise suddenly without adequate decompression time, and suffer injuries and/or die from symptoms similar to decompression sickness in humans, the premise that a ship can avoid causing severe injury or death because they can visually identify whales within the safety zone that extends to the perimeter of 180 dB, is false for two reasons: because the onset of injury appears to come from much lower sound levels and because the whales can't be seen. If the safety perimeter is to include levels of sound that might cause physical injury, injuries that come from an acute behavioral response must be included. Judging from the evidence from strandings of beaked whales in Greece, the Bahamas, Canary Islands, Baja California, and the Azores, and considering the likely received levels of sound from the location of the ships and the location of the strandings, it cannot be proven that this startle response by whales who died was not provoked by received levels of sound well below 160 dB.

Response: As discussed previously, the hypothesis proposed by Jepsen *et al.* (2003) that beaked whales suffer from DCS is considered speculative at this time. In addition, reports by Simmonds and Lopez-Jurado (1991), Martin-Martel (2003), and Frantzis (1998) on the association of beaked whale strandings concerns high intensity, mid-frequency military sonars, not low-frequency seismic activity. NMFS believes that scientifically, the stranding events in the Gulf of California and the Galapagos Islands do not constitute evidence that seismic surveys have an effect similar to that of mid-frequency sonar. The question on whether the *Ewing* seismic survey caused beaked whales to strand is a matter of considerable debate. Finally, not knowing the location of beaked whales in relation to an acoustic source does not allow one to assume that a certain sound pressure level is unsafe.

Comment MMC 9: The CBD states that there is insufficient disclosure of the compounded impact of the array's seismic output along with the other acoustical data acquisition systems, the multi-beam sonar and sub-bottom profiler. Despite the fact that the sonar and pinger will be operating continuously during the voyage, NMFS assumes there will be no additional take from these instruments individually or from all sources collectively. NMFS must address instances when all sources may not be operating simultaneously and provide a substantiated explanation why it assumes there is no enhanced impact of multiple acoustic sources operating together.

Response: This information is provided in detail in the L-DEO application and NSF EA. Although not stated in these document, additive effects from these sources will not occur because they are not operating in the same frequency, are not in phase with each other and do not have the same sound pressure levels. The multibeam sonar and sub-bottom profiler have anticipated radii of influence significantly less than that for the airgun array. NMFS has stated previously that marine mammals close enough to be affected by the multibeam sonar or sub-bottom profiler would already be affected by the airguns when they are both working. Since NMFS considers all marine mammals to be affected equally by underwater sound and does not determine which species are low-frequency hearing specialists and therefore more affected by seismic (a low-frequency source) and which species are mid- or high-frequency specialists and therefore more likely to be affected by these sonars, NMFS does not consider it necessary to conduct an analysis on the enhancement of effects for animals that might be affected by these sonars. In other words, the acoustic source with the largest zone of influence is used to determine incidental take levels.

Also, estimates of incidental take by harassment for times when the multibeam sonar and/or sub-bottom profiler are operated without airguns are not necessary because the 160–dB and 180–dB isopleths of the sub-bottom profiler and multibeam are either too small or the acoustic beams are very narrow, making the duration of the exposure and the potential for taking marine mammals by harassment small to non-existent. As provided in the L-DEO application, the 160–dB and 180–dB radii in the horizontal direction for the sub-bottom profiler are estimated to be near 20 m (66 ft) and 8 m (26 ft), respectively. In the vertical direction, the 160–dB and 180–dB radii are 160 m (525 ft) and 16 m (52 ft) directly below the hull-mounted transducer. With the *Ewing*'s beam at 14.1 m (46.25 ft) little noise is, therefore, likely to exist at the water surface beyond the immediate vicinity of the Ewing from this hull-mounted sonar. As a result, it is unlikely that marine mammals would be affected by sub-bottom profiler signals whether operating alone or in conjunction with other acoustic devices since the animals would need to be swimming immediately adjacent to the vessel or directly under the vessel. This is unlikely to occur during the *Ewing* cruise since the vessel is likely to be in transit mode, when not towing seismic, and will therefore be traveling at about 10–11 knots (18.5–20.4 km/hr) at the time.

For the Hydrosweep multi-beam sonar there is minimal horizontal propagation as these signals project downward and obliquely to the side at angles up to approximately 70 degrees from the vertical, but not horizontally. For the deep-water mode, directly under the *Ewing* the 160- and 180–dB zones are estimated to extend to 3200 m (10500 ft) and 610 m (2000 ft), respectively. However, the beam width of the Hydrosweep signal is only 2.67 degrees fore and aft of the moving vessel, meaning that a marine mammal diving (not on the surface) could receive at most 1 to 2 signals from the Hydrosweep. Also, because NMFS treats behavioral harassment or injury from pulsed sound as a function of total energy received, the actual harassment or injury threshold for Hydrosweep signals (approximately 10 millisec in duration) would be at a much higher dB level than that for longer duration pulses such as seismic or military sonar signals. As a result, NMFS believes that marine mammals are unlikely to be harassed or injured from the multibeam sonar or the Hydrosweep sonar due to the short duration and only 1 to 2 pulses received.

MMPA Concerns (MMPAC)

Comment MMPAC 1: The AWI states that L-DEO has applied for the wrong type of ''small take authorization'' asserting that the proposed project poses a lethal threat to the marine mammals and, therefore, does not qualify for an IHA, which is only allowed where there is no possibility whatsoever of causing a severe injury or death. By law, all possibility of any severe injury or deaths must be eliminated by mitigation, or not exist.

Response: While an authorization for taking marine mammals by mortality cannot be authorized under section 101(a)(5)(D) of the MMPA, those paragraphs do authorize taking by Level A harassment. Level A harassment means any act of pursuit, torment, or annoyance which has the potential to injure a marine mammal or a marine mammal stock in the wild. While it is true that an injury can be so severe that it later may result in mortality, the MMPA does not preclude issuance of an authorization under section 101(a)(5)(D) of the MMPA for activities that have the potential to cause injury. However, as NMFS shows in this document mortality and serious injury are not expected to occur during this seismic survey cruise due to implementation of mitigation measures (e.g., ramp-up, passive acoustic and visual monitoring, and quiet acoustic periods). Nor is take by mortality authorized. Therefore, issuance of an IHA is appropriate. Mitigation measures are discussed later in this document.

Comment MMPAC 2: The CBD believes NMFS has not demonstrated that the LDEO project will take only small numbers of marine mammals.

Response: NMFS believes that the small numbers requirement has been satisfied. The U.S. District Court for the Northern District of California held in *NRDC* v. *Evans* that NMFS' regulatory definition of ''small numbers'' improperly conflates it with the ''negligible impact'' definition. Even if that is the case, in the proposed IHA notice and in this document, NMFS has made a separate determination that the takes of the affected marine mammal species will be small. The species most likely to be harassed during seismic surveys in the Blanco Fracture area is the Dall's porpoise, with a ''best estimate'' of 551 animals being exposed to sound levels of 160 dB or greater. It should be understood that this does not mean that this is the number of Dall's porpoises that will be taken by Level B harassment, only the best estimate of the number of animals that potentially could have a behavioral modification due to the noise (ignoring for example that Dall's porpoise have best hearing at high frequencies, not the low frequencies used by seismic, and may not even hear seismic sounds). If in fact Dall's porpoise cannot hear the low-frequency seismic sounds, then no taking of this species will occur. Although it might be argued that the absolute number of Dall's porpoise behavioral harassment numbers may not be small, the number is relatively small, representing less than 1 percent of the regional population of that species. It should be noted that during this project, no more than 1 percent of any marine mammal stock will be potentially subject to Level B harassment.

In addition, the mitigation measures set forth by this IHA ensure that there will be negligible impacts on the marine mammals. Cetaceans are expected, at most, to show an avoidance response to the seismic pulses. Mitigation measures such as controlled speed, course alteration, visual and passive acoustic marine mammal monitoring, and shut-downs when marine mammals are detected within the defined ranges should further reduce short-term reactions to disturbance, and minimize any effects on hearing sensitivity. Due to these mitigation measures, the impacts will be negligible.

Mitigation Concerns (MIC)

Comment MIC 1: The AWI questions whether the downward directional nature of seismic airguns would be a mitigation measure as stated by L-DEO and NMFS. The AWI believes that deep diving whales, such as the beaked whale, could be hit by SPLs of at least 168 dB many kilometers from the Ewing, and no observer would ever know. Supersaturated whales might be startled to the surface very quickly, perhaps, triggering a DCS event. The applicant must disprove this potential for a wide horizontal impact zone from airgun array signals.

Response: Discussion of the potential impacts on marine mammals, including beaked whales, was provided previously in this document. Implementation of ramp-up is presumed to allow marine mammals, including beaked whales, to become aware of the approaching vessel and move away from the noise, if they find the noise annoying. This is discussed in more detail later in this section. However, the downward directionality of the seismic signal provides for lower SPLs for marine mammals, sea turtles and other marine life that spend most of their time in surface waters. As indicated in Figure 7 in L-DEO's application, a safety zone has been established at 600 m (1968 ft) for the 12–gun array (which will be used for only 24 hrs of seismic) where the 180 dB isopleth is at its maximum distance from the sound source at a water depth of 500 m (1640 ft). Therefore, in the surface waters, SPLs are more likely to be in the range of 160–170 dB and 180 dB would not be found unless in the immediate vicinity of the *Ewing*.

NMFS recognizes that deep-diving marine mammals, such as sperm whales and beaked whales, might receive higher SPLs at depth than they would at the surface. That is why the safety zone is established at the maximum distance at depth and not at the 180 dB isopleth at the surface. This provides greater protection for marine mammals in surface waters than would otherwise be warranted.

Comment MIC 2: The AWI contends that L-DEO does not have the capability to determine the actual acoustical environment (water depth, currents, mixing, lenses, channels, wave action, biologics, etc.) prior to or during an experiment, or to predict zones of potential impact on beaked whales and other marine animals. There is no empirical evidence to substantiate L-DEOs implied claim that there will be no injurious behavioral responses or direct injury, because they also lack the technology and data to determine risk thresholds within the zones. It is also inappropriate for L-DEO to assume that conditions on one day will be similar to the next day.

Response: The issue of potential impacts to beaked whales and other marine mammal species is addressed elsewhere in this document. In regard to the significance of applying empirical measurements, this can be done either on-site at the time of the acoustic work or by modeling site-specific existing data beforehand. If neither is practicable, L-DEO proposed and NMFS has implemented conservative distances for safety zones in the IHA.

It should be noted however, that the deep sound channel (SOFAR channel) is usually found in the 750–1200 m (2461–3937 ft) depth range at this latitude. For this channel to become a duct for seismic sounds from the surface, the most likely scenario would be for the seismic survey to be taking place in an area where this channel would encounter a slope which would redirect the sound into the SOFAR channel. Both seismic surveys planned for this cruise will be conducted in areas that are well below this water depth and thus increased sound propagation within the deep sound channel is not likely. Shallow water ducts are associated with continental shelves with depths less than 200 m (656 ft) in winter-time. Again this would not apply to the Blanco Fracture cruise. In regard to surface duct effects, increased sound propagation within the mixed water layer between the sea surface and the sonic layer depth could be associated with the seismic sound sources. However, it is unlikely that this effect would be significant because the downward directivity of the sound source will direct most of the energy ray path at an angle greater than the 1.76 degrees (from the surface) within which the sound will enter this duct. It should be noted that strong surface ducts are most common in nearshore areas where there is significant freshwater inflow. That is not a factor in the offshore environment of the Blanco Fracture Zone. Finally, the deep scattering layer and daily fluctuations in temperature, salinity and wave motion are considered inconsequential for calculating sound propagation for estimating safety zones.

While L-DEO has not proposed making empirical measurements of the actual acoustical environment prior to or during a survey, the Ewing has that capability if additional equipment were onboard and time was available. Calibration is principally conducted using a specially adapted spar buoy with two hydrophones suspended at depth beneath the buoy. A second system is the U.S. Navy/University of New Orleans Environmental Recording System (EARS), a bottom-moored recording system. For the Blanco Fracture cruise, neither ship time nor the equipment is available. It should also be recognized that undertaking measurements during a survey would likely result in a smaller observer complement being onboard due to berthing space. Also, because the marine mammal safety zones are conservatively established, based on the 2003 Gulf of Mexico calibration study, use of empirical measurements may result in smaller safety zones rather than larger safety zones.

Comment MIC 3: The AWI questions the validity of the L-DEO statement that the smaller size of the airgun array being deployed (10 and 12–airguns) is a mitigation measure. The AWI states that these airguns would produce 255 (peak-peak (pk-pk) and 257 dB (pk-pk), respectively, both levels among the highest anthropogenic sounds ever made.

Response: The source levels provided here are estimated from a far-field measurement that is extrapolted back to a hypothetical point 1 m (3.3 ft) from the center of a seismic array that is, in this case, 30 m (98 ft) across. Therefore, this number does not closely resemble what a marine mammal might actually experience. NMFS encourages, and works with, applicants for IHAs and Letters of Authorization to design their activity to ensure the lowest levels of sound possible going into the marine environment without compromising the success of the work planned. For the Blanco Fracture study, L-DEO has proposed using the Ewing's 10–gun (255 dB pk-pk or 241.0 dB rms) and 12–gun (257 db pk-pk, 242.7 dB rms) arrays, instead of its 20–gun (262 dB pk-pk, 244.4 dB rms) array. The larger 12–gun array will be used a total of 24 hours and the smaller 10–gun array will be used for 6.5 days at the Blanco Fracture area. The difference between the 160 dB (rms) isopleths for these two arrays is 750 m (2461 ft). If L-DEO had designed the Blanco Fracture study using the *Ewing*'s standard 20–gun array, the 160 dB isopleth would have been at 9000 m (29529 ft), or 2500 m (8202 ft) larger than the 160 dB isopleth around the 10–gun array. Because of the water depth at the site and the need to determine the structure of the oceanic crust, the 10- and 12–gun arrays were determined by L-DEO to be the smallest sources possible for use at this site. Since L-DEO chose not to use the 20–gun array, this is considered by NMFS to be a valid measure to reduce impacts on marine mammals to the lowest level practicable.

Safety Zones

Comment MIC 4: The CBD believes that NMFS' discussion of measures to ensure the least practicable impact is lacking. For example, NMFS provides no analysis of why larger safety radii were not practicable or why the additional correction factors provided in previous authorizations were not provided.

Response: Safety zones were established and are monitored closely to ensure, to the greatest extent practicable, that no marine mammals would be injured by the proposed activity. While extending safety zones to reduce Level B behavioral harassment would, in theory, result in reducing ''takes'' further, monitoring larger safety zones results in lower effort directed to the area of greatest concern, the area for potential injury. This lower effort might result in missed animals. This is not acceptable to NMFS and, for that reason, NMFS has determined that safety and monitoring zones should be established at 180 dB for cetaceans and 190 dB (rms) for pinnipeds.

Additional correction factors for calculating safety zones are necessary based on attenuation due to water depth, not because of distance from shore (although in most cases the two are related). Underwater seismic sounds are subject to spherical spreading to a distance approximately 1.5 times water depth. This is essentially what occurred in the Gulf of Mexico seismic calibration study. These additional correction factors are applied for L-DEO seismic activities taking place in water depths less than 1000 m (3281 ft), which do not apply for the Blanco Fracture study area.

Ramp-Up

Comment MIC 5: The AWI notes that ramp-up assumes that all vulnerable animals will be motivated to move away from the sound source to avoid receiving levels that may result in deleterious impacts. This assumption apparently comes exclusively from citations from Richardson concerning avoidance of bowhead and beluga whales in the path of approaching icebreakers and gray whale avoidance by Tyack during the Navy's low frequency sonar scientific research. Both of these references involved millions of times less intense levels of sound with a greatly diminished reach.

Response: In addition to providing this information in L-DEO's application, observations of behavioral changes in marine mammals in response to seismic surveys were summarized in Gordon *et al.* (2004). Those authors summarized avoidance response levels to seismic noise for a number of species with bowhead whales apparently the most sensitive (120 dB rms and above), other balaenopterid whales less sensitive (blue whales 143 dB pk-pk, humpback whales 157–160 dB pk-pk, and gray whales 164–180 dB (rms)) and dolphins and seals the least sensitive.

Comment MIC 6: The AWI notes that considerable evidence instead documents numerous behaviors such as approaching operating sources, or bowriding on vessels towing operating arrays. It is logical to expect different responses from experienced and naive individuals.

Response: As noted in greater detail in L-DEO's application and especially in Appendix A(e), there may be several reasons why marine mammals may not react to anthropogenic sounds: (1) The source is not within the frequency range for best hearing of the species; (2) the sounds at a distance from the source is not within the best hearing frequencies of the species; (3) the individual animal has a hearing impairment, and (4) the mammal(s) hear the sound but ignore the sound due to other, more important, biological concerns. If ramp-up was considered to be 100 percent effective, then observers would not be needed to monitor safety zones and could concentrate on monitoring and recording behavioral reactions to seismic sounds.

Anecdotal information obtained from observing bow-riding dolphins and dolphins rubbing on the hydophone streamer cables may indicate that bottlenose dolphins, whose best hearing frequencies are considerably higher than seismic signals, are either not affected or are tolerant of seismic signals that are not within their range of best hearing. Also, although preliminary, Smultea *et al.*(2004) found that marine mammal densities were 35 percent and 55 percent lower during periods of seismic activity than periods without seismic activity in water depths of 100–1000 m (328–3281 ft) and greater than 1000 m (3281 ft), respectively. The authors hypothesize that some cetaceans probably either moved away from the approaching seismic vessel, beyond the detection range of the observers (i.e. reacted to the seismic sounds), or changed their behavior in a way that made them less conspicuous to the observers. The differences could be a combination of these hypothesized effects. However, *Smultea et al.* (2004) also note the observed differences (especially in intermediate depths) are well within the normal range of variation that might be expected for the study area. As one cannot be certain from this single uncontrolled study what fraction of the apparent displacement effect is attributable to avoidance or behavioral responses, as opposed to natural variation, NMFS recommends priority be given to conducting a controlled exposure experiment to determine if ramping-up seismic signals provides for marine mammals protection through avoidance behavior on the part of the mammals.

Comment MIC 7: The AWI states that ramp-up cannot guarantee a response sufficient to negate any possibility of severe injury or death.

Response: As discussed in detail elsewhere in this document, NMFS believes that ramp-up of the seismic airgun array in combination with the slow vessel speed, use of trained observers, passive acoustics, shut-down procedures, and the behavioral response of marine mammals to avoid areas of high anthropogenic noise all provide protection to marine mammals from serious injury or mortality.

Comment MIC 8: One commenter stated that the ramp-up procedure is flawed. Many marine mammals travel extended distances at speeds ranging from 4–8 km/hr (2.1–4.3 knots). The proposal calls for the 160 dB contour to reach 7 km (3.8 nm) within 20 minutes, requiring travel at speeds up to 21 km/hr to remain outside it. While not explicitly stated, the 140–dB contour, at which strong behavioral responses could be expected, would reach roughly 70 km (37.8 nm) in 20 minutes, requiring travel at speeds in excess of 200 km/hr (108 knots) to remain outside it. This is a biologically unrealistic expectation.

Response: NMFS requires ramp-up in order to allow marine mammals to vacate the area that the HESS Workshop (HESS, 1999) and the NMFS Workshop believed to be a level above which injury could occur. Ramp-up is not intended to prevent marine mammals from Level B behavioral harassment. Ramp-up begins with the smallest airgun in the array (80 in^3). Airguns are added in a sequence such that the source level of the array would increase in steps not exceeding 6 dB per 5–minute period. As shown in Table 1 in this document, while the 160–dB isopleth is expected to reach 6.5 km (3.5 nm) for the 10–airgun array and 7.25 km (3.9 nm) for the 12–airgun array, the 180–dB isopleth for cetaceans would be only 550 m (1804 ft) and 600 m (1968 ft) from the *Ewing* for the 10–gun and 12–gun arrays, respectively. Using the commenter's statement that many marine mammals travel for extended periods of time at 4–8 km/hr (2.1–4.3 knots), there would not be a problem for even slower marine mammals to move out of the 180–dB safety zone within the 20 minutes required for the 12–airgun array to reach full power (Smultea *et al.* (2004).

Comment MIC 9: In response to our requirement for night-vision devices (NVDs) to be onboard the *Ewing*, one commenter stated that Generation III light enhancement gear requires significant ambient light to be effective for marine mammal viewing. It is unlikely that sufficient light will be available far from shore.

Response: Earlier this year, L-DEO completed two tests of the effectiveness of monitoring using NVDs (Smultea and Holst 2003, Appendix C; Holst 2004, Appendix B). Results of those tests indicated that the Night Quest NQ220 NVD is effective at least to 150 to 200 m (492 to 656 ft) away under certain conditions. That type of NVD is not effective at the much larger 180–dB radii applicable when a large array of airguns is in use. However, it is the smaller zone where the received level is well above 180 dB where detection of any marine mammals that are present would be of particular importance. For reasons explained elsewhere in this document, the 205–dB zone, within which TTS might occur, is likely to be about 50 m (164 ft) in radius. That is sufficiently within the range of the NVDs to allow some chance of detecting marine mammals visually within the area of potential TTS during ramp-up. Furthermore, a substantial proportion of the marine mammals that might be within that distance would be expected to move away either during ramp-up or, if the airguns were already operating, as the vessel approaches.

Comment MIC 10: The same commenter notes that his personal observation is that thermal infrared technology would be more appropriate. Not only is it usable in total darkness, warm blows of the larger marine mammals remain visible after they have submerged, and the disturbance of the surface layer also can remain visible for several seconds in a calm sea. However, in practice, even this technology has limited effectiveness. When magnification is sufficiently high to ensure marine mammals can be seen, the field of view is so small that it is difficult to point the devices in the right direction at the right time. When the field of view is increased, marine mammals may not be sufficiently large and warm to create ''warm'' pixels that will stand out above the noise.

Response: For the reasons pointed out by this marine mammal scientist, NMFS has determined that use of thermal infrared technology is not currently practicable for use in detecting marine mammals at night.

Comment MIC 11: The CBD states that NMFS' analysis of mitigation measures to ensure least practicable impact is flawed because the notice fails to require dedicated observers at night.

Response: Trained marine mammal observers using NVDs will be on watch during periods prior to and during ramp-up from a power-down situation at night. They will also be on watch at other periods during the night, particularly if marine mammals are sighted in the seismic survey area during the day or passive acoustics indicates marine mammal presence. Also, similar to several previous IHA actions, NMFS is requiring that, if marine mammals are detected during daylight hours, the passive acoustic monitoring will need to continue to be operated throughout the succeeding night (if seismic operations are underway). At other times during the night observers will be available, but it is not necessary or very effective for them to be on watch constantly. The use of passive acoustic monitoring will improve the detection of marine mammals by indicating to the visuals observers when an animal is potentially near and prompting a shut-down when necessary.

Comment MIC 12: The CBD states that there is no discussion or consideration of additional monitoring or mitigation measures, such as aerial surveys during operations to search for animals that may be affected, as well as to search nearby remote beaches for possible stranded animals. Without requiring such additional measures, or at a minimum discussing why they are not practical, NMFS cannot lawfully issue the requested authorization.

Response: Prior to issuing this IHA, NMFS thoroughly investigated all measures that might reduce the incidental taking of marine mammals to the lowest level practicable. Mitigation measures are discussed later in this document (see Mitigation). Mitigation measures, such as aerial overflights or support vessels to look for marine mammals prior to an animal entering a safety zone, may be given consideration if the safety zone cannot be adequately monitored from the source vessel. Consideration also must be given to aircraft/vessel availability, access to nearby airfields, distance from an airfield to the survey area, and the aircraft's flight duration. There are serious safety issues regarding aircraft flights over water that must be considered prior to requiring aerial overflights. Additional consideration must be given to the potential for aircraft to also result in Level B harassment since a plane or helicopter would need to fly at low altitudes to be effective. Because the safety zones for this proposed activity are relatively small ($\leq$ 600 m (1968 ft)) and can be monitored from the *Ewing*, use of aircraft or a second vessel for mitigation purposes is not warranted.

Even if aircraft or a second vessel are not necessary or feasible to monitor a safety zone, they might be appropriateto monitor shorelines (presumably for strandings related to the activity). NMFS has weighed this suggestion carefully and has determined that for this survey, neither aircraft, vessel or a land-based team is warranted due to the great distances between the survey site and the nearest land, and the prevailing currents that would tend to move a dead marine mammal lateral to the shore instead of immediately ashore, meaning the animal might land many miles from the nearest shoreside location. However, NMFS has notified the NMFS Stranding

Network regarding the calendar dates that the *Ewing* will be operating sonar off the coast of Oregon.

For this survey, the most appropriate monitoring is for the biological observers onboard the *Ewing* to also monitor the previously run transect lines as the *Ewing* returns along a parallel transect track. Survey lines for this survey are from 0.5 km (0.3 nm) to 2 km (1.1 nm) apart in a concentrated area. Additionally, observers will continue to monitor for marine mammals while the *Ewing* repositions to run another seismic line. Zamboni-style seismic surveys provide extensive opportunities for the biological observers to look for distressed, injured or dead marine mammals (although no injuries or mortalities are expected during this research cruise). The IHA requires immediate suspension of seismic activity and immediate notification to NMFS is an observation is made of a distressed or recently deceased marine mammal. Also, a final post-survey transect will be conducted by the *Ewing* as it retrieves the hydrophone array and as it transits from the survey location to San Diego, CA.

Endangered Species Act (ESA) Concerns (ESAC)

Comment ESAC 1: The CBD states that L-DEO's proposed project may affect 7 species listed as endangered under the ESA. As a result, consultation under section 7 of the ESA must occur prior to authorization of the project. NMFS has not yet complied with its (ESA) duties, and thus may not issue a small take authorization for the LDEO project.

Response: NMFS has completed consultation under section 7 of the ESA. The biological opinion resulting from that consultation concluded that this action is not likely to jeopardize the continued existence of listed species or result in the destruction or adverse modification of critical habitat.

National Environmental Policy Act (NEPA) Concerns (NEPAC)

Comment NEPAC 1: The CBD states that NSF and NMFS have never prepared a comprehensive Environmental Impact Statement (EIS) that fully analyzes the environmental impacts of its seismic surveys, either individually or collectively, as well as provide the public with the critical opportunity to participate in the decision making process as required by NEPA for actions of this magnitude. The CBD believes that NMFS must prepare an EIS prior to approving this project.

Response: NMFS disagrees that an EIS is required for this action. An EA was prepared by NSF for this action. NMFS fully reviewed the EA and announced its availability to allow for public review and comment (69 FR 31792, June 7, 2004). Thereafter, NMFS adopted the NSF EA and made a Finding of No Significant Impact (FONSI), determining that an EIS was not required.

NMFS also does not agree that its issuance of multiple IHAs for seismic surveys requires an EIS. Each seismic survey and corresponding IHA is geographically and/or temporally spaced and unrelated to others for purposes of evaluating environmental impacts.

Comment NEPA 2: Prior to approving this project, NMFS must prepare an EIS. An EIS is required if ''substantial questions are raised as to whether a project...may cause significant degradation of some human environmental factor.'' (*Idaho Sporting Congress* v. *Thomas*, 137 F.3d 1146, 1149–50 (9th Circ. 1998) citing *Greenpeace Action* v. *Franklin*, 14 F.3d 1146, 1149–1150 (9th Cir. 1998). In this case, CBD asserts an EIS is required because substantial questions have been raised as to the significance factors found in 40 CFR 1508.27(b). First, CBD states there are ''uncertain impacts or unknown risks'' associated with this project and other similar seismic surveys and geophysical activities undertaken by L-DEO and NSF and authorized by NMFS. There exist large data gaps regarding the impacts of acoustics on marine life. Given the many stranding events that have been linked to underwater acoustics, including the melon-headed whale stranding near Hanalei Bay, Hawaii, a more detailed analysis in the form of a full EIS is more than warranted. CBD also asserts there is significant controversy over the impacts of underwater seismic activity on the environment. In support, CBD states that there are extremely divergent views on how substantial a change in behavior or activity is required before an animal should be deemed to be harassed or impacted, what received levels can be considered ''safe,'' what mitigation measures are effective, and, in general, how to proceed in the face of existing scientific uncertainty on these and other issues.

Response: While NMFS agrees that there are some unknown risks and uncertain impacts associated with this project, the major outstanding issue is in regard to the biological mechanism that caused some sound-related strandings to occur. It is important to note that those strandings occurred in the absence of standard mitigation and monitoring measures employed by seismic vessels that are designed to prevent serious impacts. Also, it is recognized by many scientists that data gaps exist because of the difficulty of obtaining data in a humane manner on many of the species. NMFS is in the process of developing more species-specific guidelines, but that information is not yet available for use. In the interim, surrogate species are used and conservative mitigation measures taken to ensure that injury or mortality to these animals does not occur. NMFS' FONSI takes into account the considerable mitigation and monitoring efforts required by the IHA to counter the uncertainty of impacts and risks. NMFS also would like to clarify that the melon-headed whale stranding near Hanalei Bay, as with other strandings that coincided with underwater anthropogenic acoustic events, was not caused by seismic survey work.

NMFS does not agree that there is a substantial dispute about the impacts of this action (including all required mitigation and monitoring). Calculations for Level B harassment for this action were based upon conservative assumptions of distance from the source for impact in that L-DEO did not make a judgement as to whether the anticipated impacts would be biologically significant. The actual impacts of the action were analyzed based on the best available science. There was no information suggesting that the mitigation measures are not effective, and, in fact, empirical information from previous surveys suggest they are effective. Moreover, NMFS is charged with basing its decisions on the best available scientific information. Also, while there is currently some debate regarding how effective mitigation measures are, the estimates of take (mortality, injury, or harassment) were made without taking mitigation into account.

Comment NEPAC 3: The CBD states that L-DEO, NSF, and numerous private seismic vessels, may have as yet unanalyzed cumulatively significant effects on the environment. Cumulative impacts is the ''impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions. The EA generally describes fishing, shipping and other vessel noise, but provides no discussion of actual or potential impacts on the marine environment, either individually or cumulatively. Instead, the EA summarily concludes that actual or potential impacts ''are expected to be no more than a very minor (and short-term) within the study area, even when viewed in light of other human activities occurring in the area.'' The CBD claims that this explanation turns the cumulative impacts requirement on its head.

Response: The NSF EA adequately addresses the cumulative impacts of a short-term, low-intensity seismic airgun survey in relation to long-term noise and taking events, such as shipping, fishing, and marine tourism. These other activities are long-term activities which are unaffected by NMFS' action here. Nor does this action, when considered in light of the other activities, becomes significant.

Comment NEPA 4: Because the proposed survey has the potential to expose single individuals to repeated sound exposures, the CBD also believes that the analysis is insufficient as the EA fails to analyze what the cumulative behavioral or other impacts to L-DEO's proposal may be on these individuals.

Response: The issue of repeated exposures is discussed in the NSF EA and in the L-DEO application. This information was summarized in Table 4 of the application and in Table 2 in both the proposed IHA notice and this document. As those documents note, the difference between the number of exposures calculated versus the number of individuals that may be exposed to SPLs ≥ 160 dB is important for this survey because the proposed survey plan calls for repeated airgun operations through the same or adjacent waters. If many marine mammals are present near any of the survey transit lines, then many of the same individuals are likely to be approached by the operating airguns more than once during the 7–day survey operation. However, any animals that react to distant seismic sounds by moving away from the area are not likely to be present and affected during any subsequent transit lines that are run. Estimates of the number of exposures are, therefore, considered precautionary overestimates of the actual numbers of different individuals potentially exposed to seismic sounds, because in all likelihood, exposures represent repeated exposures of some of the same individuals and not all animals will react to the sound exposure, as described in L-DEO's application. For this survey, therefore, both the numbers of individuals in each species/stock potentially exposed to SPLs ≥ 160 dB and the number of potential exposures that a marine mammal may experience are small in number and not likely to have more than a negligible impact on marine mammal populations.

Comment NEPAC 5: The CBD states that the proposed project and other activities in the area have the potential to impact species listed under the ESA, including sperm, humpback, sei, fin, blue, and North Pacific right whales, the Steller sea lion, and the leatherback sea turtles. The EA does not adequately discuss this impact and instead concludes that the ''brief exposure'' of these listed species equates to an insignificant impact. Mere conclusions in an EA do not satisfy NEPA. The presence of these and other significance factors clearly triggers the need for an EIS.

Response: NMFS believes that the impacts on marine species listed under the ESA have been adequately addressed in NSF's EA. In addition, impacts on marine species listed under the ESA have been addressed in NMFS' Biological Opinion on this action. The finding of that biological opinion is that this action is not likely to jeopardize the continued existence of listed species or result in the destruction or adverse modification of critical habitat. No listed species are expected to be killed or seriously injured, and all impacts will be short-term resulting in no more than minor behavioral harassment. No critical habitat will be affected. A copy of the Biological Opinion has been forwarded to the CBD as requested.

Comment NEPAC 6: The CBD states that the EA lacks the required environmental baseline data and adequate analysis of impacts and mitigation measures for marine mammals, sea turtles, fish, and other marine life as discussed previously.

Response: NMFS disagrees. The NSF EA provides a level of detail not usually found in many EAs. The EA provides a step-by-step analysis on how impacts were assessed, starting with (and citing) the best scientific information available on marine mammal and sea turtle distribution and abundance and using those data to make conservative estimates on levels of take by harassment and reasonable assumptions on why no marine mammals are likely to be injured or killed by this survey. A discussion on addressing the mitigation measures as alternatives to the proposed action is provided in the next response.

Comment NEPAC 7: The CBD states that the EA does not evaluate a reasonable range of alternatives to the proposed action. The EA does not analyze any alternative that incorporates more mitigation or otherwise lessens the impacts of the seismic operations on the marine environment. Impacts on protected marine species from airgun surveys are not just temporary or transient but have the significant potential to result in lethal impacts. Such impacts clearly require better analsysis in the EA and the preparation of a full EIS.

Response: Discussion on the potential for marine mammal mortality by seismic sounds has been discussed previously in this document. NMFS reviewed the range of alternatives addressed in NSF's EA and agrees with CBD that the alternatives can be expanded by providing an additional analysis of the mitigation measures that have been identified for use during seismic surveys (but not necessarily practicable for each and every survey). For reader convenience that discussion has been provided in this document. It is also found in NMFS' FONSI statement (see NEPA later in this document).

Comment NEPA 8: The CBD states that the EA is also grossly deficient in its discussion of potential impacts to fish species. While the EA briefly analyses the impacts of fishing on marine mammals and secondary impacts to fish as food for marine mammals, the EA fails to analyze impacts to fish stocks themselves.

Response: In the EA, NSF notes that ''fish often react to sounds, especially strong and/or intermittent sounds of low frequency. Sound pulses at received levels of 160 dB re 1 μPa (peak) may cause subtle changes in behavior. Pulses at levels of 180 dB (peak) may cause noticeable changes in behavior (Chapman and Hawkins, 1969; Pearson *et al.*, 1992; Skalski *et al.*, 1992).'' It also appears that fish often habituate to repeated strong sounds rather rapidly, on time scales of minutes to an hour. Finally, exposure to seismic sound is considered unlikely to result in direct, or even cryptic, fish mortality (Department of Fisheries, 2004). Although not tested independently, post-seismic monitoring has not indicated fish kills (IBID, 2004). NMFS therefore believes that while significant changes in behavior would mean that these fish might be unavailable for fisheries, there would not be a long-term impact on fish stocks themselves. NMFS is confident that the EA has provided the level of information necessary to determine that the *Ewing* survey in the Northeast Pacific Ocean will not have a significant effect on fish stocks, because, as stated in the EA, it will not have more than a short-term behavioral response on the part of the fish themselves.

Description of Habitat and Marine Mammals Affected by the Activity

A detailed description of the NPO in the Blanco Fracture/Gorda Ridge area and its associated marine mammals can be found in the L-DEO application and a number of documents referenced in the L-DEO application, and is not repeated here. This document is available online at: *http://www.nmfs.noaa.gov/prot__res/PR2/Small__Take/smalltake__info.htm#applications.*

The main Blanco Transform survey site, and the Gorda Ridge contingency survey site, are located approximately 450 and 150 km (243 and 81 nm) offshore from Oregon, respectively, over water depths of 1600 to 5000 m (5250 to 16405 ft). Based on their preference for offshore (>2000 m (6560 ft) depth) and/or slope (200–2000 m or 656–6560 ft) waters, 19 of the 39 marine mammal species known to occur in Oregon and Washington waters are considered likely to occur near the survey areas. An additional 14 species could occur, but are unlikely to occur in the project area because they are rare or uncommon in slope and offshore waters or they generally do not occur off Oregon or Washington. While these 14 species are addressed in the L-DEO application it is unlikely that they will occur in the survey area. An additional six species are not expected in the project area because their occurrence off Oregon is limited to coastal/shallow waters (gray whale and sea otter) or they are considered extralimital (beluga whale, ringed seals, ribbon seal, and hooded seal). As it is unlikely that these rare, vagrant mammals would occur during the short time period of this seismic survey, these latter six species are not addressed further as they are unlikely to be impacted by seismic signals from this research operation.

The six species of marine mammals expected to be most common in the deep pelagic or slope waters of the project area include the Pacific white-sided dolphin, northern right whale dolphin, Risso's dolphin, short-beaked common dolphin, Dall's porpoise , and northern fur seal (Green *et al.* 1992, 1993; Buchanan *et al.* 2001; Carretta *et al.* 2002; Barlow 2003). The sperm whale , pygmy sperm whale, mesoplodont species (Blainville's beaked whale, Stejneger's beaked whale, and Hubb's beaked whale), Baird's beaked whale, Cuvier's beaked whale, and northern elephant seals are considered pelagic species but are generally uncommon in the waters near the survey area.

Of the five species of pinnipeds known to occur regularly in waters off Oregon, Washington, or northern California, only the northern fur seal and northern elephant seal are likely to be present in the pelagic waters of the proposed project area, located approximately 150–450 km (243–481 nm) offshore. The Steller sea lion may also occur there in small numbers. The California sea lion and harbor seal occur in shallow coastal or shelf waters off Oregon and Washington (Bonnell et al. 1992, Green *et al.* 1993, Buchanan *et al.* 2001), and are not expected to be seen in the proposed study area. Sea otters were translocated to shallow coastal waters off the Olympic Peninsula of Washington, but are not found in the pelagic waters of the project area off Oregon. More detailed information on these species is contained in the L-DEO application and additional information is contained in Caretta *et al.* (2002) which are available at: *http://www.nmfs.noaa.gov/prot__res/PR2/Small__Take/smalltake__info.htm#applications*, and *http://www.nmfs.noaa.gov/prot__res/PR2/Stock__Assessment__Program/sars.html*, respectively.

Potential Effects on Marine Mammals

The effects of sounds from airgun arrays might include one or more of the following: tolerance, masking of natural sounds, behavioral disturbance and perhaps temporary or permanent hearing impairment (Richardson *et al.* 1995). In addition, intense acoustic events may cause trauma to tissues associated with organs vital for hearing, sound production, respiration and other functions. This trauma may include minor to severe hemorrhage.

Effects of Seismic Surveys on Marine Mammals

The L-DEO application provides the following information on what is known about the effects on marine mammals of the types of seismic operations planned by L-DEO. The types of effects considered here are (1) masking, (2) disturbance, and (3) potential hearing impairment and other physical effects. Additional discussion on species specific effects can be found in the L-DEO application.

Masking

Masking effects of pulsed sounds on marine mammal calls and other natural sounds are expected to be limited, although there are very few specific data on this. Seismic sounds are short pulses occurring for less than 1 sec every 20 or 60–90 sec in this project. Sounds from the multibeam sonar are very short pulses, occurring for 1–10 msec once every 1 to 15 sec, depending on water depth. (During operations in deep water, the duration of each pulse from the multibeam sonar as received at any one location would actually be only 1/5th or at most 2/5th of 1–10 msec, given the segmented nature of the pulses.) Some whales are known to continue calling in the presence of seismic pulses. Their calls can be heard between the seismic pulses (Richardson *et al.* 1986; McDonald et al. 1995, Greene *et al.* 1999). Although there has been one report that sperm whales cease calling when exposed to pulses from a very distant seismic ship (Bowles *et al.* 1994), a recent study reports that sperm whales continued calling in the presence of seismic pulses (Madsen *et al.* 2002). Masking effects of seismic pulses are expected to be negligible in the case of the smaller odontocete cetaceans, given the intermittent nature of seismic pulses and that sounds important to these species are predominantly at much higher frequencies than are airgun sounds.

Most of the energy in the sound pulses emitted by airgun arrays is at low frequencies, with strongest spectrum levels below 200 Hz and considerably lower spectrum levels above 1000 Hz. These frequencies are mainly used by mysticetes, but not by odontocetes or pinnipeds. An industrial sound source will reduce the effective communication or echolocation distance only if its frequency is close to that of the cetacean signal. If little or no overlap occurs between the industrial noise and the frequencies used, as in the case of many marine mammals relative to airgun sounds, communication and echolocation are not expected to be disrupted. Furthermore, the discontinuous nature of seismic pulses makes significant masking effects unlikely even for mysticetes.

A few cetaceans are known to increase the source levels of their calls in the presence of elevated sound levels, or possibly to shift their peak frequencies in response to strong sound signals (Dahlheim 1987, Au 1993, Lesage *et al.* 1999, Terhune, 1999; as reviewed in Richardson *et al.* 1995). These studies involved exposure to other types of anthropogenic sounds, not seismic pulses, and it is not known whether these types of responses ever occur upon exposure to seismic sounds. If so, these adaptations, along with directional hearing and preadaptation to tolerate some masking by natural sounds (Richardson *et al.* 1995), would all reduce the importance of masking.

Disturbance by Seismic Surveys

Disturbance includes a variety of effects, including subtle changes in behavior, more conspicuous dramatic changes in activities, and displacement. However, there are difficulties in defining which marine mammals should be counted as ''taken by harassment.'' For many species and situations, scientists do not have detailed information about their reactions to noise, including reactions to seismic (and sonar) pulses. Behavioral reactions of marine mammals to sound are difficult to predict. Reactions to sound, if any, depend on species, state of maturity, experience, current activity, reproductive state, time of day, and many other factors. If a marine mammal does react to an underwater sound by changing its behavior or moving a small distance, the impacts of the change may not rise to the level of disruption of a behavioral pattern. However, if a sound source would displace marine mammals from an important feeding or breeding area for a prolonged period, such a disturbance would constitute Level B harassment. Given the many uncertainties in predicting the quantity and types of impacts of noise on marine mammals, scientists often resort to estimating how many mammals may be present within a particular distance of industrial activities or exposed to a particular level of industrial sound. This likely overestimates the numbers of marine mammals whose behavioral patterns may be disrupted. The sound exposure criteria used to estimate how many marine mammals might be harassed behaviorally by the seismic survey are based on behavioral observations during studies of several species. However, information is lacking for many species.

Hearing Impairment and Other Physical Effects

Temporary or permanent hearing impairment is a possibility when marine mammals are exposed to very strong sounds, but there has been no specific documentation of this for marine mammals exposed to airgun pulses. Current NMFS policy regarding exposure of marine mammals to high-level sounds is that cetaceans and pinnipeds should not be exposed to impulsive sounds ≤180 and 190 dB re 1 microPa (rms), respectively (NMFS 2000). Those criteria have been used in defining the safety (shut down) radii for seismic surveys. However, those criteria were established before there were any data on the minimum received levels of sounds necessary to cause auditory impairment in marine mammals. As discussed in the L-DEO application and summarized here,

1. The 180 dB criterion for cetaceans is probably quite precautionary, i.e., lower than necessary to avoid TTS let alone permanent auditory injury, at least for delphinids.

2. The minimum sound level necessary to cause permanent hearing impairment is higher, by a variable and generally unknown amount, than the level that induces onset TTS.

3. The level associated with the onset of TTS is often considered to be a level below which there is no danger of permanent damage.

Several aspects of the planned monitoring and mitigation measures for this project are designed to detect marine mammals occurring near the airgun array (and multibeam sonar), and to avoid exposing them to sound pulses that might cause hearing impairment. In addition, many cetaceans are likely to show some avoidance of the area with ongoing seismic operations. In these cases, the avoidance responses of the animals themselves will reduce or avoid the possibility of hearing impairment.

Non-auditory physical effects may also occur in marine mammals exposed to strong underwater pulsed sound. Possible types of non-auditory physiological effects or injuries that theoretically might occur in mammals close to a strong sound source include stress, neurological effects, bubble formation, resonance effects, and other types of organ or tissue damage. It is possible that some marine mammal species (*i.e.*, beaked whales) may be especially susceptible to injury and/or stranding when exposed to strong pulsed sounds. The following paragraphs discuss the possibility of TTS, permanent threshold shift (PTS), and non-auditory physical effects.

TTS

TTS is the mildest form of hearing impairment that can occur during exposure to a strong sound (Kryter 1985). When an animal experiences TTS, its hearing threshold rises and a sound must be stronger in order to be heard. TTS can last from minutes or hours to (in cases of strong TTS) days. Richardson *et al.* (1995) note that the magnitude of TTS depends on the level and duration of noise exposure, among other considerations. For sound exposures at or somewhat above the TTS threshold, hearing sensitivity recovers rapidly after exposure to the noise ends. Little data on sound levels and durations necessary to elicit mild TTS have been obtained for marine mammals.

For toothed whales exposed to single short pulses, the TTS threshold appears to be, to a first approximation, a function of the energy content of the pulse (Finneran *et al.* 2002). Given the available data, the received level of a single seismic pulse might need to be on the order of 210 dB re 1 microPa rms (approx. 221 226 dB pk pk) in order to produce brief, mild TTS. Exposure to several seismic pulses at received levels near 200 205 dB (rms) might result in slight TTS in a small odontocete, assuming the TTS threshold is (to a first approximation) a function of the total received pulse energy (Finneran *et al.*, 2002). Seismic pulses with received levels of 200 205 dB or more are usually restricted to a radius of no more than 100 m (328 ft) around a seismic vessel.

There are no data, direct or indirect, on levels or properties of sound that are required to induce TTS in any baleen whale. TTS thresholds for pinnipeds exposed to brief pulses (single or multiple) have not been measured, although exposures to pulses up to 183 db re 1 microPa (rms) have been shown to be insufficient to induce TTS in California sea lions (Finneran *et al.* (2003). However, prolonged exposures show that some pinnipeds may incur TTS at somewhat lower received levels than do small odontocetes exposed for similar durations (Kastak *et al.* 1999, Ketten *et al.* 2001, Au *et al.* 2000).

A marine mammal within a radius of ≤100 m (≤ 328 ft) around a typical array of operating airguns might be exposed to a few seismic pulses with levels of ≥205 dB, and possibly more pulses if the mammal moved with the seismic vessel. As noted previously, most cetacean species tend to avoid operating airguns, although not all individuals do so. In addition, ramping up airgun arrays, which is now standard operational protocol for L-DEO and other seismic operators, should allow cetaceans to move away from the seismic source and avoid being exposed to the full acoustic output of the airgun array. It is unlikely that these cetaceans would be exposed to airgun pulses at a sufficiently high level for a sufficiently long period to cause more than mild TTS, given the relative movement of the vessel and the marine mammal. However, TTS would be more likely in any odontocetes that bow-ride or otherwise linger near the airguns. Odontocetes would be at or above the surface while bow-riding, and thus not exposed to strong sound pulses given the pressure-release effect at the surface. However, bow-riding animals generally dive below the surface intermittently. If they did so while bow-riding near airguns, they would be exposed to strong sound pulses, possibly repeatedly. If some cetaceans did incur TTS through exposure to airgun sounds, it would very likely be a temporary and reversible phenomenon.

NMFS currently believes that, whenever possible to avoid Level A harassment, cetaceans should not be exposed to pulsed underwater noise at received levels exceeding 180 dB re 1 microPa (rms). The corresponding limit for pinnipeds has been set at 190 dB. The predicted 180- and 190–dB received level distances for the airgun arrays operated by L-DEO during this activity are summarized elsewhere in this document. These sound levels are not considered to be the levels at or above which TTS might occur. Rather, they are the received levels above which, in the view of a panel of bioacoustics specialists convened by NMFS (at a time before TTS measurements for marine mammals started to become available), one could not be certain that there would be no injurious effects, auditory or otherwise, to marine mammals. As noted here, TTS data that are now available imply that, at least for dolphins and belugas, TTS is unlikely to occur unless the dolphins are exposed to airgun pulses substantially stronger than 180 dB re 1 microPa (rms).

It has also been shown that most whales tend to avoid ships and associated seismic operations. Thus, whales will likely not be exposed to such high levels of airgun sounds. Because of the slow ship speed, any whales close to the trackline could move away before the sounds become sufficiently strong for there to be any potential for hearing impairment. Therefore, there is little potential for whales being close enough to an array to experience TTS. In addition ramping up airgun arrays, which has become standard operational protocol for many seismic operators including L-DEO, should allow cetaceans to move away from the seismic source and to avoid being exposed to the full acoustic output of the airgun array.

Permanent Threshold Shift (PTS)

When PTS occurs there is physical damage to the sound receptors in the ear. In some cases there can be total or partial deafness, while in other cases the animal has an impaired ability to hear sounds in specific frequency ranges. Physical damage to a mammal's hearing apparatus can occur if it is exposed to sound impulses that have very high peak pressures, especially if they have very short rise times (time required for sound pulse to reach peak pressure from the baseline pressure). Such damage can result in a permanent decrease in functional sensitivity of the hearing system at some or all frequencies.

Single or occasional occurrences of mild TTS are not indicative of permanent auditory damage in terrestrial mammals. However, very prolonged exposure to sound strong enough to elicit TTS, or shorter-term exposure to sound levels well above the TTS threshold, can cause PTS, at least in terrestrial mammals (Kryter 1985). Relationships between TTS and PTS thresholds have not been studied in marine mammals but are assumed to be similar to those in humans and other terrestrial mammals. The low-to-moderate levels of TTS that have been induced in captive odontocetes and pinnipeds during recent controlled studies of TTS have been confirmed to be temporary, with no measurable residual PTS (Kastak *et al.* 1999, Schlundt *et al.* 2000, Finneran *et al.* 2002, Nachtigall *et al.* 2003). In terrestrial mammals, the received sound level from a single non-impulsive sound exposure must be far above the TTS threshold for any risk of permanent hearing damage (Kryter 1994, Richardson *et al.* 1995). For impulse sounds with very rapid rise times (e.g., those associated with explosions or gunfire), a received level not greatly in excess of the TTS threshold may start to elicit PTS. Rise times for airgun pulses are rapid, but less rapid than for explosions.

Some factors that contribute to onset of PTS are as follows: (1) exposure to single very intense noises, (2) repetitive exposure to intense sounds that individually cause TTS but not PTS, (3) recurrent ear infections or (in captive animals) exposure to certain drugs, and (4) normal aging process.

Cavanagh (2000) has reviewed the thresholds used to define TTS and PTS. Based on his review and SACLANT (1998), it is reasonable to assume that PTS might occur at a received sound level 20 dB or more above that which induces mild TTS. However, for PTS to occur at a received level only 20 dB above the TTS threshold, it is probable that the animal would have to be exposed to the strong sound for an extended period.

Sound impulse duration, peak amplitude, rise time, and number of pulses are the main factors thought to determine the onset and extent of PTS. Based on existing data, Ketten (1994) has noted that the criteria for differentiating the sound pressure levels that result in PTS (or TTS) are location and species-specific. PTS effects may also be influenced strongly by the health of the receiving animal's ear.

Given that marine mammals are unlikely to be exposed to received levels of seismic pulses that could cause TTS, it is highly unlikely that they would sustain permanent hearing impairment. If we assume that the TTS threshold for exposure to a series of seismic pulses in odontocetes may be on the order of 220 dB re 1 microPa (pk-pk), then the PTS threshold might be about 240 dB re 1 microPa (pk-pk). In the units used by geophysicists, this is 10 bar-m. Such levels are found only in the immediate vicinity of the largest airguns (Richardson *et al.* 1995, Caldwell and Dragoset 2000). It is very unlikely that an odontocete would remain within a few meters of a large airgun for sufficiently long to incur PTS. Baleen whales generally avoid the immediate area around operating seismic vessels, so it is unlikely that a baleen whale could incur PTS from exposure to airgun pulses. Some pinnipeds do not show strong avoidance of operating airguns. However, pinnipeds are expected to be (at most) uncommon in the Blanco Fracture survey area. However, although it is unlikely that the planned seismic surveys could cause PTS in any marine mammals, caution is warranted given the limited knowledge about noise-induced hearing damage in marine mammals, particularly baleen whales.

Strandings and Mortality

Marine mammals close to underwater detonations of high explosives can be killed or severely injured, and the auditory organs are especially susceptible to injury (Ketten *et al.* 1993, Ketten 1995). Airgun pulses are less energetic and have slower rise times than underwater detonations, and, while there is no documented evidence that airgun arrays can cause serious injury, death, or stranding, the temporal association of strandings of beaked whales with naval exercises and, more recently, an L-DEO seismic survey has raised the possibility that beaked whales may be especially susceptible to injury and/or stranding when exposed to strong pulsed sounds.

In March 2000, several beaked whales that had been exposed to repeated pulses from high intensity, mid-frequency military sonars stranded and died in the Providence Channels of the Bahamas Islands, and were subsequently found to have incurred cranial and ear damage (NOAA and USN 2001). Based on post-mortem analyses, it was concluded that an acoustic event caused hemorrhages in and near the auditory region of some beaked whales. These hemorrhages occurred before death. They would not necessarily have caused death or permanent hearing damage, but could have compromised hearing and navigational ability (NOAA and USN 2001). The researchers concluded that acoustic exposure caused this damage and triggered stranding, which resulted in overheating, cardiovascular collapse, and physiological shock that ultimately led to the death of the stranded beaked whales. During the event, five naval vessels used their AN/SQS–53C or -56 hull-mounted active sonars for a period of 16 hours. The sonars produced narrow (<100 Hz) bandwidth signals at center frequencies of 2.6 and 3.3 kHz (-53C), and 6.8 to 8.2 kHz (-56). The respective source levels were usually 235 and 223 dB re 1 μPa, but the -53C briefly operated at an unstated but substantially higher source level. The unusual bathymetry and constricted channel where the strandings occurred were conducive to channeling sound into surface waters. This, and the extended operations by multiple sonars, apparently prevented escape of the animals to the open sea. In addition to the strandings, there are reports that beaked whales were no longer present in the Providence Channel region after the event, suggesting that other beaked whales either abandoned the area or perhaps died at sea (Balcomb and Claridge 2001).

Other strandings of beaked whales associated with operation of military sonars have also been reported (e.g., Simmonds and Lopez-Jurado 1991, Frantzis 1998). In these cases, it was not determined whether there were noise-induced injuries to the ears or other organs. Another stranding of beaked whales (15 whales) happened on 24–25 September 2002 in the Canary Islands, where naval maneuvers were taking place in the area. Jepson *et al.* (2003) concluded that cetaceans might be subject to decompression injury (i.e., the bends or air embolism) in some situations. If so, this might occur if the mammals ascend unusually quickly when exposed to aversive sounds. Previously, it was widely assumed that diving marine mammals are not subject to decompression injury and currently there are no data to question that assumption.

It is important to note that seismic pulses and mid-frequency sonar pulses are quite different. Sounds produced by the types of airgun arrays used to profile sub-sea geological structures are broadband with most of the energy below 1 kHz. Typical military mid-frequency sonars operate at frequencies of 2 to 10 kHz, generally with a relatively narrow bandwidth at any one time (though the center frequency may change over time). Because seismic and sonar sounds have considerably different characteristics and duty cycles, it is not appropriate to assume that there is a direct connection between the effects of military sonar and seismic surveys on marine mammals. However, evidence that sonar pulses can in special circumstances lead to hearing damage and, indirectly, to mortality suggests that caution is warranted when dealing with exposure of marine mammals to any high-intensity pulsed sound.

In addition to the sonar-related strandings, there was a September, 2002 stranding of two Cuvier's beaked whales in the Gulf of California (Mexico) when a seismic survey by the *Ewing* was underway in the general area (Malakoff 2002). The airgun array in use during that project was the *Ewing*'s 20–gun 8490–in^3 array. This may possibly be a first indication that seismic surveys can have effects, at least on beaked whales, similar to the suspected effects of naval sonars. However, the evidence linking the Gulf of California strandings to the seismic surveys is inconclusive, and to this date is not based on any physical evidence (Hogarth 2002, Yoder 2002). The ship was also operating its multi-beam bathymetric sonar at the same time but this sonar had much less potential than these naval sonars to affect beaked whales. Although the link between the Gulf of California strandings and the seismic (plus multi-beam sonar) survey is inconclusive, this event plus the various incidents involving beaked whale strandings associated with naval exercises suggests a need for caution in conducting seismic surveys in areas occupied by beaked whales.

Non-auditory Physiological Effects.

Possible types of non-auditory physiological effects or injuries that might theoretically occur in marine mammals exposed to strong underwater sound includes stress, neurological effects, bubble formation, resonance effects, and other types of organ or tissue damage. There is no evidence that any of these effects occur in marine mammals exposed to sound from airgun arrays. It should be noted that seismic has been used far more extensively than tactical sonar, but currently information on strandings associated with seismic is not as clear as it is with sonar. However, there have been no direct studies of the potential for airgun pulses to elicit any of these effects. If any such effects do occur, they would probably be limited to unusual situations when animals might be exposed at close range for unusually long periods.

Long-term exposure to anthropogenic noise may have the potential to cause physiological stress that could affect the health of individual animals or their reproductive potential, which could theoretically cause effects at the population level (Gisner (ed.) 1999). However, there is essentially no information about the occurrence of noise-induced stress in marine mammals. Also, it is doubtful that any single marine mammal would be exposed to strong seismic sounds during a seismic survey for a sufficiently long period of time that significant physiological stress would develop. For the Blanco Fracture study, the survey area is only 70 km2 and the survey will last less than one week.

Gas-filled structures in marine animals have an inherent fundamental resonance frequency. If stimulated at this frequency, the ensuing resonance could cause damage to the animal. There may also be a possibility that high sound levels could cause bubble formation in the blood of diving mammals that in turn could cause an air embolism, tissue separation, and high, localized pressure in nervous tissue (Gisner [ed] 1999, Houser *et al.* 2001). In 2002, NMFS held a workshop (Gentry [ed.] 2002) to discuss whether the stranding of beaked whales in the Bahamas in 2000 might have been related to air cavity resonance or bubble formation in tissues caused by exposure to noise from naval sonar. A panel of experts concluded that resonance in air-filled structures was not likely to have caused this stranding. Among other reasons, the air spaces in marine mammals are too large to have resonant frequencies equal to frequencies emitted by mid- or low-frequency sonar; lung tissue damage has not been observed in any mass, multi-species stranding of beaked whales; and the duration of sonar pings is likely too short to induce vibrations that could damage tissues (Gentry (ed.) 2002). Opinions were less conclusive about the possible role of gas (nitrogen) bubble formation/growth in the Bahamas stranding of beaked whales. Workshop participants did not rule out the possibility that bubble formation/growth caused by static diffusion played a role in the stranding and participants acknowledged that more research is needed in this area. The only available information on acoustically-mediated bubble growth in marine mammals is modeling that assumes prolonged exposure to sound.

In summary, little is known about the potential for seismic survey sounds to cause either auditory impairment or other non-auditory physical effects in marine mammals. Available data suggest that such effects, if they occur at all, would be limited to short distances from the sound source. However, the available data do not allow for meaningful quantitative predictions of the numbers (if any) of marine mammals that might be affected in these ways. Marine mammals that show behavioral avoidance of seismic vessels, including most baleen whales, some odontocetes, and some pinnipeds, are unlikely to incur auditory impairment or other physical effects.

Possible Effects of Mid-Frequency Sonar Signals

A multi-beam bathymetric sonar (Atlas Hydrosweep DS–2, 15.5–kHz) and a sub-bottom profiler will be operated from the source vessel during much of the planned survey. Details about these sonars were provided previously in this document.

Navy sonars that have been linked to avoidance reactions and stranding of cetaceans generally (1) are more powerful than the Atlas Hydrosweep and sub-bottom profiler, (2) have a longer pulse duration than these two instruments, and (3) are directed close to horizontally (vs. downward for the Hydrosweep and sub-bottom profiler). Also, the area of possible influence of the Hydrosweep and sub-bottom profiler is much smaller - a narrow band below the source vessel. For the Hydrosweep, there is no horizontal propagation as these signals project at an angle of approximately 45 degrees from the ship. For the deep-water mode, under the ship the 160- and 180–dB zones are estimated to be 3200 m (10500 ft) and 610 m (2000 ft), respectively. However, the beam width of the Hydrosweep signal is only 2.67 degrees fore and aft of the vessel, meaning that a marine mammal diving could receive at most 1–2 signals from the Hydrosweep and a marine mammal on the surface would be unaffected.

Marine mammals that do encounter the Hydrosweep at close range are unlikely to be subjected to repeated pulses because of the narrow fore-aft width of the beam, and will receive only limited amounts of pulse energy because of the short pulses and vessel speed.

Sounds from the sub-bottom profiler are very short pulses, occurring for 1, 2 or 4 ms once every second with a stated maximum source level of 204 dB re 1 Pa-m. Most of the energy in the sound pulses emitted by this sub-bottom profiler is at mid frequencies, centered at 3.5 kHz. The beamwidth is approximately 30 and is directed downward. Thus the received level would be expected to decrease to 160 and 180 dB about 160 m (525 ft) and 16 m (52 ft) below the µtransducer, respectively, assuming spherical spreading. Corresponding distances in the horizontal plane would be lower, given the directionality of this source (30 beamwidth) and the measurements of Burgess and Lawson (2000).

Therefore, as harassment or injury from pulsed sound is a function of total energy received, the actual harassment or injury threshold for Hydrosweep signals (approximately 10 ms) and sub-bottom profiler signals (approximately 1–4 ms) would be at a much higher dB level than that for longer duration pulses such as sonar signals. As a result, NMFS believes that marine mammals are unlikely to be harassed or injured from either the multibeam sonar or the sub-bottom profiler.

Masking by Mid-Frequency Sonar Signals

Marine mammal communications will be not masked appreciably by the multibeam sonar signals or the sub-bottom profiler given the low duty cycle and directionality of the sonars and the brief period when an individual mammal is likely to be within its beam. Furthermore, in the case of baleen whales, the sonar signals do not overlap with the predominant frequencies of the calls, which would avoid significant masking.

Behavioral Responses Resulting from Mid-Frequency Sonar Signals

Behavioral reactions of free-ranging marine mammals to military and other sonars appear to vary by species and circumstance. Observed reactions have included silencing and dispersal by sperm whales (Watkins *et al.* 1985), increased vocalizations and no dispersal by pilot whales (Rendell and Gordon 1999), and the previously-mentioned beachings by beaked whales. Also, Navy personnel have described observations of dolphins bow-riding adjacent to bow-mounted mid-frequency sonars during sonar transmissions. However, all of these observations are of limited relevance to the present situation. Pulse durations from those sonars were much longer than those of the L-DEO multibeam sonar, and a given mammal would have received many pulses from the naval sonars. During L-DEO's operations, the individual pulses will be very short, and a given mammal would not receive many of the downward-directed pulses as the vessel passes by.

Captive bottlenose dolphins and a white whale exhibited changes in behavior when exposed to 1–sec pulsed sounds at frequencies similar to those that will be emitted by the multi-beam sonar used by L-DEO and to shorter broadband pulsed signals. Behavioral changes typically involved what appeared to be deliberate attempts to avoid the sound exposure (Schlundt et al. 2000, Finneran et al. 2002). The relevance of these data to free-ranging odontocetes is uncertain and in any case the test sounds were quite different from a bathymetric sonar in either duration or bandwidth.

L-DEO and NMFS are not aware of any data on the reactions of pinnipeds to sonar sounds at frequencies similar to those of the 15.5 kHz frequency of the Ewing's multibeam sonar. Based on observed pinniped responses to other types of pulsed sounds, and the likely brevity of exposure to the bathymetric sonar sounds, pinniped reactions are expected to be limited to startle or otherwise brief responses of no lasting consequences to the individual animals. Finally, the pulsed signals from the sub-bottom profiler are much weaker than those from the airgun array and the multibeam sonar. Therefore, behavioral responses are not expected.

Hearing Impairment and Other Physical Effects

Given recent stranding events that have been associated with the operation of naval sonar, there is much concern that sonar noise can cause serious impacts to marine mammals (for discussion see Effects of Seismic Surveys). It is worth noting that the multi-beam sonar proposed for use by L-DEO is quite different than sonars used for navy operations. Pulse duration of the multi-beam sonar is very short relative to the naval sonars. Also, at any given location, an individual marine mammal would be in the beam of the multi-beam sonar for a very limited time given the generally downward orientation of the beam and its narrow fore-aft beamwidth. (Navy sonars often use near-horizontally-directed sound.) These factors would all reduce the sound energy received from the multi-beam sonar rather drastically relative to that from the sonars used by the Navy. Therefore, hearing impairment by the multi-beam bathymetric sonar is unlikely.

Source levels of the sub-bottom profiler are much lower than those of the airguns and the multi-beam sonar. Sound levels from a sub-bottom profiler similar to the one on the *Ewing* were estimated to decrease to 180 dB re 1 microPa (rms) at 8 m (26 ft) horizontally from the source (Burgess and Lawson 2000), and at approximately 18 m downward from the source. Furthermore, received levels of pulsed sounds that are necessary to cause temporary or especially permanent hearing impairment in marine mammals appear to be higher than 180 dB (see earlier discussion). Thus, it is unlikely that the sub-bottom profiler produces pulse levels strong enough to cause hearing impairment or other physical injuries even in an animal that is (briefly) in a position near the source.

The sub-bottom profiler is usually operated simultaneously with other higher-power acoustic sources. Many marine mammals will move away in response to the approaching higher-power sources or the vessel itself before the mammals would be close enough for there to be any possibility of effects from the less intense sounds from the sub-bottom profiler. In the case of mammals that do not avoid the approaching vessel and its various sound sources, mitigation measures that would be applied to minimize effects of the higher-power sources would further reduce or eliminate any minor effects of the sub-bottom profiler.

Estimates of Take by Harassment for the Blanco Fracture Zone Survey

Although information contained in this document indicates that injury to marine mammals from seismic sounds potentially occurs at sound pressure levels higher than 180 and 190 dB, NMFS' current criteria for onset of Level A harassment of cetaceans and pinnipeds from impulse sound are, respectively, 180 and 190 re 1 microPa rms. The rms level of a seismic pulse is typically about 10 dB less than its peak level (Greene 1997, McCauley *et al.* 1998, 2000a). The criterion for Level B harassment onset is 160 dB.

Given the proposed mitigation (see Mitigation later in this document), all anticipated takes would be limited to Level B harassment. The proposed mitigation measures will minimize or eliminate the possibility of Level A harassment. L-DEO has calculated the ''best estimates'' for the numbers of animals that could be taken by level B harassment during the proposed Blanco Fracture seismic survey using data on marine mammal density and abundance from marine mammal surveys in the region, and estimates of the size of the affected area, as shown in the predicted RMS radii table (Table 1).

These estimates are based on a consideration of the number of marine mammals that might be exposed to sound levels greater than 160 dB, the criterion for the onset of Level B harassment, by operations with the 10- and 12–gun array planned to be used for this project. The anticipated radius of influence of the multi-beam sonar is less than that for the airgun array, so it is assumed that any marine mammals close enough to be affected by the multi-beam sonar would already be affected by the airguns. Therefore, no additional incidental takings are included for animals that might be affected by the multi-beam sonar.

Conclusions- Effects on Cetaceans

Strong avoidance reactions by several species of mysticetes to seismic vessels have been observed at ranges up to 6–8 km (3.2–4.3 nm) and occasionally as far as 20–30 km (10.8–16.2 nm) from the source vessel. However, reactions at the longer distances appear to be atypical of most species and situations. Furthermore, if they are encountered, the numbers of mysticetes estimated to occur within the 160–dB isopleth at the Blanco Fracture and Gorda Ridge survey sites are expected to be low. In addition, the estimated numbers presented in Table 2 are considered overestimates of actual numbers for two primary reasons. First, the number of line kilometers used to estimate the number of exposures and individuals exposed assumes that both the main and contingency surveys will be completed; this is highly unlikely given the likelihood that some inclement weather, equipment malfunction, and/or implementation of mitigative shut downs or power downs will occur. Secondly, the estimated 160–dB radii used here are probably overestimates of the actual 160–dB radii at deep water sites such as the Blanco Fracture and Gorda Ridge sites (Tolstoy *et al.* 2004).

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TABLE 2. Estimates of the possible numbers of marine mammal exposures to different sound levels, and the numbers of different individuals that might be exposed, during L-DEO's proposed main Blanco Transform seismic survey and the Gorda Ridge contingency survey (combined) off Oregon in July 2004. The column of numbers in boldface shows the numbers of "takes" for which authorization is requested.[a]

	Number of Exposures to Sound Levels ≥160 dB		Number of Individuals Exposed to Sound Levels ≥160 dB			
			Best Estimate			
Species	**Best Estimate**	**Maximum Estimate**	**Number**	**% of Regional Pop'n**[b]	**Maximum Estimate**	**Requested Take Authorization**
Physeteridae						
Sperm whale	*17*	*27*	*5*	*0.0*	*7*	**27**
Pygmy sperm whale	11	29	3	*0.1*	8	**29**
Dwarf sperm whale	0	0	0	NA	0	**5**
Ziphiidae						
Cuvier's beaked whale	0	0	0	0.0	0	**2**
Baird's beaked whale	5	8	1	0.0	2	**8**
Blainville's beaked whale				NA		**20**
Hubb's beaked whale				NA		**54**
Stejneger's beaked whale				NA		**54**
Mesoplodon sp. (unidentified)	49	128	13	0.1	35	
Delphinidae						
Bottlenose dolphin	0	0	0	0.0	0	**10**
Striped dolphin	2	4	1	0.0	1	**10**
Short-beaked common dolphin	225	370	61	0.0	101	**370**
Pacific white-sided dolphin	564	641	154	0.3	175	**641**
Northern right-whale dolphin	423	599	115	0.6	163	**599**
Risso's dolphin	425	481	116	0.7	131	**481**
False killer whale	0	0	0	0.0	0	**10**
Killer whale	43	69	12	0.1	19	**69**
Short-finned pilot whale	0	0	0	0.0	0	**50**
Phocoenidae						
Harbor porpoise	0	0	0	0.0	0	**5**
Dall's porpoise	2021	4511	551	0.5	1230	**4511**
Balaenopteridae						
North Pacific right whale	*0*	*0*	0	*0.0*	*0*	**2**
Humpback whale	*9*	*21*	2	*0.0*	*6*	***21***
Minke whale	14	25	4	*0.0*	7	**25**
Sei whale	*0*	*0*	0	*0.0*	*0*	**2**

Fin whale	*20*	*23*	5	*0.1*	*6*	***23***
Blue whale	2	*6*	1	*0.0*	*2*	***6***

TABLE 2. continued

Pinnipeds						
Northern fur seal	288	1833	79	*0.0*	500	**1833**
California sea lion						**5**
Steller sea lion						***10***
Harbor seal						**5**
Northern elephant seal	53	53	15	*0.0*	15	**53**

[a] Best estimate and maximum estimates of density are from Table 3 in application.

[b] Regional population size estimates are from Table 2 in application.

[c] NA indicates that regional population estimates are not available.

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Odontocete reactions to seismic pulses, or at least the reactions of dolphins, are expected to extend to lesser distances than are those of mysticetes. Odontocete low-frequency hearing is less sensitive than that of mysticetes, and dolphins are often seen from seismic vessels. In fact, there are documented instances of dolphins approaching active seismic vessels. However, dolphins as well as some other types of odontocetes sometimes show avoidance responses and/or other changes in behavior when near operating seismic vessels.

Taking into account the mitigation measures that are required to be undertaken, effects on cetaceans are generally expected to be limited to avoidance of the area around the seismic operation and short-term changes in behavior, falling within the MMPA definition of Level B harassment. Furthermore, the estimated numbers of animals potentially exposed to sound levels sufficient to cause appreciable disturbance are small percentages of the population sizes in the NPO generally.

The best estimates of the numbers of individual cetaceans that may be exposed to sounds ≥160 dB re 1 microPa (rms)(the current criterion for level B harassment) represent 0 to 0.7 percent of the populations of each species in the NPO. For species listed as endangered under the ESA, this includes no North Pacific right whales or sei whales; less than 0.02 percent of the NPO populations of sperm, humpback and blue whales; and 0.1 percent of the fin whale population (Table 2). In the cases of mysticetes, beaked whales, and sperm whales, these exposure levels are expected to involve no more than very small numbers (0 to 7) of individual cetaceans. Sperm and fin whales are the endangered species that are most likely to be exposed, and their NPO populations are approximately 26,053 and 8520, respectively (Ohsumi and Wada 1974, Carretta *et al.* 2002).

It is highly unlikely that any right whales will be exposed to seismic sounds ≥160 dB re 1 microPa (rms). This conclusion is based on the rarity of this species off Oregon/Washington and in the NPO generally (less than 100, Carretta *et al.* 2002), and information that the remnant population of this species apparently migrates to more northerly areas during the summer. However, L-DEO has requested an authorization to expose up to two North Pacific right whales to ≥160 dB, given the possibility (however unlikely) of encountering one or more of this endangered species. If a right whale is sighted by the vessel-based observers, the airguns will be shut down (not just powered down) regardless of the distance of the whale from the airgun array.

Larger numbers of delphinids may be affected by the proposed main and contingency seismic studies, but the population sizes of species likely to occur in the operating area are large, and the numbers potentially affected are small relative to the population sizes. As indicated in Table 2, the best estimate of number of individual delphinids that might be exposed to sounds greater than or equal to 160 dB re 1 microPa (rms) represents a small percentage of the populations of each species occurring there.

Varying estimates of the numbers of marine mammals that might be exposed to airgun sounds during the October 2004 seismic surveys off Oregon have been presented, depending on the specific exposure criteria, calculation procedures (exposures vs. individuals), and density criteria used (best vs. maximum). The requested ''take authorization'' for each species is based on the estimated maximum number of exposures to ≥160 dB re 1 microPa (rms). That figure likely overestimates (in most cases by a large margin) the actual number of animals that will be exposed to these sounds; the reasons for this have been outlined previously. Even so, the combined estimates for the main and contingency surveys are quite low percentages of the population sizes. Furthermore, mitigation measures such as controlled speed, course alternation, look outs, non-pursuit, ramp ups, and power downs or shut downs when marine mammals are seen within defined ranges should further reduce any short-term reactions, and minimize any effects on hearing sensitivity. In all cases, these relatively short-term exposures are unlikely to result in any long-term negative consequences for the individuals or their populations.

In light of the type of take expected and the small numbers of affected stocks, the action is expected to have no more than a negligible impact on the affected species or stocks of marine mammals. In addition, mitigation measures such as controlled vessel speed, course alteration, look-outs, ramp-ups, and power-downs when marine mammals are seen within defined ranges (see Mitigation) should further reduce short-term reactions to disturbance, and minimize any effects on hearing sensitivity.

Conclusions- Effects on Pinnipeds

Two pinniped species, the northern fur seal and the northern elephant seal, are likely to be encountered at the survey sites, as they are associated with pelagic slope and offshore waters off

Oregon. In addition, it is possible (although unlikely) that a small number of Steller sea lions, California sea lions, and/or harbor seals may also be encountered, most likely at the Gorda Ridge survey area located closer to shore in continental slope water; these three species tend to inhabit primarily coastal and shelf waters. An estimated 79 individual fur seals and 15 individual elephant seals may be exposed to airgun sounds with received levels ≥160 dB re 1 microPa (rms). It is most likely that no California sea lions, Steller sea lions, or harbor seals will be exposed to such sounds. Similar to cetaceans, the estimated numbers of pinnipeds that may be exposed to received levels ≤160 dB are probably overestimates of the actual numbers that will be significantly affected. This action would therefore have no more than a negligible impact on the affected species or stocks of pinnipeds.

Potential Effects on Habitat

The proposed seismic survey will not result in any permanent impact on habitats used by marine mammals, or to the food sources they utilize. The main impact issue associated with the proposed activity will be temporarily elevated noise levels and the associated direct effects on marine mammals. The actual area that will be affected by the OBSs will be a very small fraction of the marine mammal habitat and the habitat of their food species in the area; thus, any effects are expected to be highly localized and insignificant. The use of OBSs would result in no more than a negligible and highly localized short-term disturbance to sediments and benthic organisms. The area that might be disturbed is a very small fraction of the overall area occupied by fish or marine mammal species.

One of the reasons for the adoption of airguns as the standard energy source for marine seismic surveys was that they (unlike the explosives used in the distant past) do not result in any appreciable fish kill. Various experimental studies showed that airgun discharges cause little or no fish kill, and that any injurious effects were generally limited to the water within a meter or so of an airgun. However, it has recently been found that injurious effects on captive fish, especially on fish hearing, may occur to somewhat greater distances than previously thought (McCauley *et al.*, 2000a,b, 2002; 2003). Even so, any injurious effects on fish would be limited to short distances from the source. Also, many of the fish that might otherwise be within the zone within the injury zone are likely to be displaced from this region prior to the approach of the airguns through avoidance reactions to the passing seismic vessel or to the airgun sounds as received at distances beyond the injury radius.

Fish often react to sounds, especially strong and/or intermittent sounds of low frequency. Sound pulses at received levels of 160 dB re 1 µPa (peak) may cause subtle changes in behavior. Pulses at levels of 180 dB (peak) may cause noticeable changes in behavior (Chapman and Hawkins, 1969; Pearson *et al.*, 1992; Skalski *et al.*, 1992). It also appears that fish often habituate to repeated strong sounds rather rapidly, on time scales of minutes to an hour. However, the habituation does not endure, and resumption of the disturbing activity may again elicit disturbance responses from the same fish. Fish near the airguns are likely to dive or exhibit some other kind of behavioral response. This might have short-term impacts on the ability of cetaceans to feed near the survey area. However, only a small fraction of the available habitat would be ensonified at any given time, and fish species would return to their pre-disturbance behavior once the seismic activity ceased. Thus, the proposed surveys would have little impact on the abilities of marine mammals to feed in the area where seismic work is planned. Some of the fish that do not avoid the approaching airguns (probably a small number) may be subject to auditory or other injuries.

Zooplankton that are very close to the source may react to the airgun's impulse. These animals have an exoskeleton and no air sacs; therefore, little or no mortality is expected. Many crustaceans can make sounds and some crustacea and other invertebrates have some type of sound receptor. However, the reactions of zooplankton to sound are not known. Some mysticetes feed on concentrations of zooplankton. A reaction by zooplankton to a seismic impulse would only be relevant to whales if it caused a concentration of zooplankton to scatter. Pressure changes of sufficient magnitude to cause this type of reaction would probably occur only very close to the source, so few zooplankton concentrations would be affected. Impacts on zooplankton behavior are predicted to be negligible, and this would translate into negligible impacts on feeding mysticetes.

Potential Effects on Subsistence Use of Marine Mammals

There is no subsistence hunting for those marine mammal stocks potentially affected by the Blanco Fracture seismic survey, so the proposed activity will not have any impact on the availability of the species or stocks for subsistence users.

Mitigation

For the proposed Blanco Fracture seismic survey, L-DEO will deploy a 10- or 12–airgun array as an energy source, with discharge volumes of 3050 in^3 and 3705 in^3, respectively. The airguns in the arrays will be spread out horizontally so the energy from the array will be directed mostly downward. The directional nature of the arrays to be used in this project is an important mitigating factor. This directionality will result in reduced sound levels at any given horizontal distance as compared with the levels expected at that distance if the source were omnidirectional with the stated nominal source level. Because the actual seismic source is a distributed sound source (10–12 airguns) rather than a single point source, the highest sound levels measurable at any location in the water will be less than the nominal source level. Also, the size of the airgun arrays (which are smaller than the 20–gun array used for some other surveys) is another important mitigation measure that will reduce the potential for effects relative to those that might occur with a larger array of airguns. This is in conformance with NMFS' encouraging seismic operators to use the lowest intensity airguns practical to accomplish research objectives.

Safety Radii

Received sound levels have been modeled by L-DEO in relation to distance and direction from the two arrays. The radii around the 10–airgun array where the received levels would be 180 dB and 190 dB re 1 µPa (rms) were estimated as 550 m (1805 ft) and 200 m (656 ft), respectively. For the 12–airgun array, the radii around the array where the received levels would be 180 dB and 190 dB re 1 µPa (rms) were estimated as 600 m (1969 ft) and 250 m (820 ft), respectively. The 180 and 190 dB shutdown criteria, applicable to cetaceans and pinnipeds, respectively, are specified by NMFS (2000) and, as mentioned previously in this document, are considered conservative for protecting marine mammals from potential injury.

Empirical data concerning these safety radii have been acquired based on measurements during the acoustic verification study conducted in the northern Gulf of Mexico from 27 May to 3 June 2003 under an IHA issued to L-DEO (see 68 FR 32460, May 30, 200). A copy of that report (Tolstoy *et al.*, 2004) is available on-line at: *http://www.nmfs.noaa.gov/prot__res/PR2/*

Small__Take/smalltake__info.htm#applications, L-DEO's analysis of the acoustic data from that study provides limited measurements in deep water, the situation relevant here. Those data indicate that, for deep water, the model tends to overestimate the received sound levels at a given distance. Until additional data become available, it is proposed that safety radii during airgun operations in deep water, including the planned operations off Oregon, will be the values predicted by L-DEO's model. Previously, more conservative (larger) safety radii that are 1.5 times the modeled radii have been used for these surveys. However, given that these modeled radii are already conservative (i.e., overestimates) for deep water situations, even without the X 1.5 factor, these larger radii will not be used during this seismic survey.

Mitigation Measures

The following mitigation measures, as well as marine mammal visual monitoring (discussed later in this document), are required to be carried out for the subject seismic surveys, provided that they do not compromise operational safety requirements of the *Ewing*: (1) Speed and course alteration; (2) power-down and shut-down procedures; (3) ramp-up procedures; (4) use of passive acoustics to detect vocalizing marine mammals; and (5) incorporation of non-seismic/sonar periods to allow marine mammals to surface from deep dives if acoustic sounds are disrupting dive patterns. Some of these mitigation measures will also be implemented to protect sea turtles. In addition, stricter mitigation measures will be implemented for the North Pacific right whale.

Speed and Course Alteration

If a marine mammal is detected outside the appropriate safety radius and, based on its position and the relative motion, is likely to enter the safety radius, the vessel's speed and/or direct course will be changed if this is practical while minimizing the effects on planned science objectives. Given the presence of the streamer and airgun array behind the vessel, the turning rate of the vessel with trailing streamer and array is no more than five degrees per minute, limiting the maneuverability of the vessel during operations. The marine mammal activities and movements relative to the seismic vessel will be closely monitored to ensure that the marine mammal does not approach within the safety radius. If the mammal appears likely to enter the safety radius, further mitigative actions will be taken, (*i.e.*, either further course alterations or shutdown of the airguns).

Power-down and Shut-down Procedures

A power down involves decreasing the number of airguns in use such that the radius of the 180–dB (or 190–dB) zone is decreased to the extent that marine mammals are not in the safety zone. A power down may also occur when the vessel is moving from one seismic line to another, unless the full airgun array is scheduled to be operated during line changes. During a power down, one 80 in3 airgun will continue to be operated. The continued operation of one airgun is intended to alert marine mammals to the presence of the seismic vessel in the area. In contrast, a shut down occurs when all airgun activity is suspended.

If a marine mammal is detected outside the safety radius but is likely to enter the safety radius, and if the vessel's speed and/or course cannot be changed to avoid having the mammal enter the safety radius, the airguns will be powered down before the mammal is within the safety radius. Likewise, if a mammal is already within the safety zone when first detected, the airguns will be powered down immediately. During a power down, at least one airgun (e.g., 80 in3) will be operated. If a marine mammal is detected within or near the smaller safety radius around that single airgun (Table 1), all airguns will be shut down.

Following a power down, airgun activity will not resume until the marine mammal has cleared the safety zone. The animal will be considered to have cleared the safety zone if it (1) is visually observed to have left the safety zone, or (2) has not been seen within the zone for 15 min in the case of small odontocetes and pinnipeds, or (3) has not been seen within the zone for 30 min in the case of mysticetes and large odontocetes, including sperm, pygmy sperm, dwarf sperm, and beaked whales.

During a power down, the operating airgun will be shut down if a marine mammal approaches within the modeled safety radius for the then-operating source, typically a single gun of 80 in^3. Because no calibration measurements have been done to confirm the modeled safety radii for the single gun, conservative radii may be used (1.5 times the modeled safety radius). For an 80 in^3 airgun, the predicted 180–dB distance applicable to cetaceans is 36 m (118 ft) and the x1.5 conservative radius is 54 m (177 ft). The corresponding 190–dB radius applicable to pinnipeds is 13 m (43 ft), with the x1.5 conservative radius being 20 m (66 ft). If a marine mammal is detected within or about to enter the appropriate safety radius around the small source in use during a power down, airgun operations will be entirely shut down. In addition, the airguns will be shut down if a North Pacific right whale is sighted anywhere near the vessel, even if it is located outside the safety radius, because of the rarity and sensitive status of this species. Resumption of airgun activity will follow procedures described for power-down operations.

Ramp-up Procedure

When airgun operations commence after a certain period without airgun operations, the number of guns firing will be increased gradually, or ''ramped up'' (also described as a ''soft start''). Operations will begin with the smallest gun in the array (80 in^3). Guns will be added in sequence such that the source level of the array will increase in steps not exceeding 6 dB per 5–min period over a total duration of approximately 18–20 minutes. Throughout the ramp-up procedure, the safety zone for the full 10- or 12–gun array will be maintained.

The ''ramp-up'' procedure will be required under the following circumstances. Under normal operational conditions (vessel speed 4 knots (7.4 km/hr)), a ramp-up would be required after a power-down or shut-down period lasting more than 4 minutes if the *Ewing* was towing the 10– or 12–gun array. At 4 knots, the *Ewing* would travel 600 m (1969 ft) during a 5–minute period. The 600–m (1969 ft) distance is the calculated 180–dB safety radius.

If the towing speed is reduced to 3 knots (5.6 km/hr) or less, as sometimes required when maneuvering in shallow water (not a factor here), it is proposed that a ramp-up would be required after a ''no shooting'' period lasting greater than 7 minutes. At towing speeds not exceeding 3 knots (5.6 km/hr), the source vessel would travel no more than 600 m (1969 ft) in about 7 minutes. Based on the same calculation, a ramp-up procedure would be required after a 4–minute period if the speed of the source vessel was 5 knots (9.3 km/hr).

Ramp-up will not occur if the safety radius has not been visible for at least 30 minutes prior to the start of ramp-up operations in either daylight or nighttime. If the safety radius has not been visible for that 30–minute period (e.g., during darkness or fog), ramp-up will not commence unless at least one airgun has been firing continuously during the interruption of seismic activity. That airgun will have a source level of at least 180 dB re 1 microPa m (rms). It is likely that the airgun arrays will not be ramped up from a complete shut down at night or in thick fog, because the outer part of the safety zone for those arrays will not be visible during those conditions. If one airgun has operated during a power down period, ramp up to full power will be permissible at night or in poor visibility, on the assumption that marine mammals will be alerted to the approaching seismic vessel by the sounds from the single airgun and could move away. Ramp up of the airguns will not be initiated if a marine mammal is sighted within or near the applicable safety radii during the day or close to the vessel at night.

Non-seismic/sonar Periods

To address the current hypothesis that seismic and/or sonar sounds are preventing normal dive patterns by beaked whales, NMFS and L-DEO will implement an acoustic flushing method to allow marine mammals (principally beaked whales) to vacate an area prior to the use of more intense acoustic sounds. Although NMFS believes that beaked whales will generally avoid vessels and vessel noise and, in this instance are unconstrained by topography from moving away from the acoustic source in either their horizontal or vertical movements in the ways that are suspected to have contributed to recent beaked whale strandings. However, in order to address new hypotheses (discussed previously in this document), NMFS and L-DEO will implement the following mitigation measures:

OBS Deployments

L-DEO will secure the multibeam and sub-bottom sonars until approximately 10 minutes prior to deployment of the OBS. At this time these two sonars will commence operation to ensure that the depths and bottom topography are in accordance with the planned OBS location. Immediately after the OBS has been deployed and the Ewing is underway to the next site, these sonars will be secured until 10 minutes from the OBS deployment site.

Shooting Periods During Turns

The volume of the airgun array will be reduced during vessel turns while running seismic lines. L-DEO will develop a protocol that will address the operation's capability to reduce sound in the water column with a reasonable ramp up period following the period of volume reduction. The multi-beam and 3.5 kHz bottom profiler will be secured during turns (unless there is a safety issue).

Night-time Seismic

Comments on past proposed IHAs raised the issue of prohibiting night-time operations as mitigation. However, this is not practicable due to cost considerations. The daily cost to the Federal Government to operate vessels such as *Ewing* is approximately $33,000 to $35,000/day (Ljunngren, pers. comm. May 28, 2003). If the vessels were prohibited from operating during nighttime, it is possible that each trip would require an additional 3 to 5 days, or up to $175,000 more, depending on average daylight at the time of work.

Taking into consideration the additional costs of prohibiting night-time operations and the likely impact of the activity (including all mitigation and monitoring), NMFS has determined that the mitigation and monitoring required to be undertaken during this research cruise, including the new requirements to secure the mid-frequency sonars between OBS deployments and during seismic turns, ensures that the activity will have the least practicable impact on the affected species or stocks. Marine mammals will have sufficient notice of a vessel approaching with operating seismic airguns (at least 1 hour in advance), thereby giving them an opportunity to avoid the approaching array; if ramp-up is required after an extended power-down, two marine mammal observers will be required to monitor the safety radii using night vision devices for 30 minutes before ramp-up begins and verify that no marine mammals are in or approaching the safety radii; ramp-up may not begin unless the entire safety radii are visible; and ramp-up may occur at night only if one airgun with a sound pressure level of at least 180 dB has been maintained during interruption of seismic activity. Therefore it is likely that the 10–12–airgun array will not be ramped-up from a shut-down at night.

Marine Mammal Monitoring

L-DEO must have at least three visual observers and two passive acoustic system biological monitors on board the vessels, and at least two must be experienced marine mammal observers that NMFS approves. These observers will be on duty in shifts of no longer than 4 hours.

The visual observers will monitor marine mammals and sea turtles near the seismic source vessel during all daytime airgun operations, during any nighttime start-ups of the airguns and at night, whenever daytime monitoring resulted in one or more power-down situations due to marine mammal presence. During daylight, vessel-based observers will watch for marine mammals and sea turtles near the seismic vessel during periods with shooting (including ramp-ups), and for 30 minutes prior to the planned start of airgun operations after an extended power-down or shut-down.

Use of multiple observers will increase the likelihood that marine mammals near the source vessel are detected. L-DEO bridge personnel will also assist in detecting marine mammals and implementing mitigation requirements whenever possible (they will be given instruction on how to do so), especially during ongoing operations at night when the designated observers are on stand-by and not required to be on watch at all times.

The observer(s) will watch for marine mammals and sea turtles from the highest practical vantage point on the vessel, which is either the bridge or the flying bridge. On the bridge of the *Maurice Ewing*, the observer's eye level will be 11 m (36 ft) above sea level, allowing for good visibility within a 210 arc. If observers are stationed on the flying bridge, the eye level will be 14.4 m (47.2 ft) above sea level. The observer(s) will systematically scan the area around the vessel with Big Eyes binoculars, reticle binoculars (e.g., 7 X 50 Fujinon) and with the naked eye during the daytime. Laser range-finding binoculars (Leica L.F. 1200 laser rangefinder or equivalent) will be available to assist with distance estimation. The observers will be used to determine when a marine mammal or sea turtle is in or near the safety radii so that the required mitigation measures, such as course alteration and power-down or shut-down, can be implemented. If the airguns are powered or shut down, observers will maintain watch to determine when the animal is outside the safety radius.

Observers will not be on duty during ongoing seismic operations at night; bridge personnel will watch for marine mammals during this time and will call for the airguns to be powered-down if marine mammals or sea turtles are observed in or about to enter the safety radii. However, an observer must be on standby at night and available to assist the bridge watch if marine mammals are detected. If the airguns are ramped-up at night from a power-down situation, at least two marine mammal observers will monitor for marine mammals for 30 minutes prior to ramp-up and during the ramp-up using night vision equipment that must be available (ITT F500 Series Generation 3 binocular image intensifier or equivalent). All observer activity will be assisted by passive acoustic monitoring.

Passive (Acoustic) Monitoring (PAM)

L-DEO will use the PAM system during the OBS deployment (1) to assess pre-disturbance vocalization behavior, (2) during all seismic operations; and (3) while the *Ewing* is retrieving the hydrophone array and OBSs after completion of the survey. The primary purpose of the acoustic monitoring is to aid visual observers in detecting vocalizing marine mammals, particularly during periods with poor observation conditions, including high sea states, fog, or darkness, when visual monitoring is largely or totally ineffective (Smultea *et al.*, 2004). Passive acoustic equipment was first used on the *Ewing* during the 2003 Sperm Whale Seismic Study conducted in the Gulf of Mexico and subsequently was evaluated by L-DEO to determine whether it was practical to incorporate it into future seismic research cruises. The SEAMAP system has been used successfully in L-DEO's SE Caribbean study (69 FR 24571, May 4, 2004). Smultea *et al.* (2004) provides additional information on testing and evaluating the PAM system during this cruise.

The SEAMAP PAM system has four hydrophones, which allow the SEAMAP system to derive the bearing toward the a vocalizing marine mammal. In order to operate the SEAMAP system, the marine mammal monitoring contingent onboard the *Ewing* will be increased by 2 to 3 additional biologists who will monitor the SEAMAP system. Verification of acoustic contacts will then be attempted through visual observation by the marine mammal observers. However, the PAM system by itself usually does not determine the distance that the vocalizing mammal might be from the seismic vessel. It can be used as a cue by the visual observers as to the presence of an animal and to its approximate bearing (with some ambiguity). At this time, however, it is doubtful if PAM can be used as a trigger to initiate power-down of the array. Perhaps with continued studies the relationship between a signal on a passive acoustic array and distance from the array can be determined with sufficient accuracy to be used for this purpose without complementary visual observations.

Reporting

L-DEO will submit a report to NMFS within 90 days after the end of the cruise in late October, 2004. The report will describe the operations that were conducted and the marine mammals that were detected. The report must provide full documentation of methods, results, and interpretation pertaining to all monitoring tasks. The report will summarize the dates and locations of seismic operations, marine mammal sightings (dates, times, locations, activities, associated seismic survey activities), and estimates of the amount and nature of potential take of marine mammals by harassment or in other ways. This report will be considered the final report unless NMFS provides comments to L-DEO on the 90–day report within 30 days of receipt.

Endangered Species Act (ESA)

NMFS has issued a biological opinion regarding the effects of this action on ESA-listed species and critical habitat under the jurisdiction of NMFS. That biological opinion concluded that this action is not likely to jeopardize the continued existence of listed species or result in the destruction or adverse modification of critical habitat. A copy of the Biological Opinion is available upon request (see **ADDRESSES**).

National Environmental Policy Act (NEPA)

The NSF made a FONSI determination on February 6, 2004, based on information contained within its EA, that implementation of the subject action is not a major Federal action having significant effects on the environment within the meaning of NEPA. NSF determined, therefore, that an environmental impact statement would not be prepared. On June 7, 2004 (69 FR 31792), NMFS noted that the NSF had prepared an EA for the Blanco Fracture Zone surveys and made this EA available upon request. In accordance with NOAA Administrative Order 216–6 (Environmental Review Procedures for Implementing the National Environmental Policy Act, May 20, 1999), NMFS has reviewed the information contained in NSF's EA and determined that the NSF EA accurately and completely describes the proposed action alternative, and the potential impacts on marine mammals, endangered species, and other marine life that could be impacted by the preferred alternative and the other alternatives. Accordingly, NMFS adopted the NSF EA under 40 CFR 1506.3 and made its own FONSI. The NMFS FONSI also takes into consideration additional mitigation measures required by the IHA that are not in NSF's EA. Therefore, it is not necessary to issue a new EA, supplemental EA or an environmental impact statement for the issuance of an IHA to L-DEO for this activity. A copy of the NSF EA and the NMFS FONSI for this activity is available upon request (see **ADDRESSES**).

Conclusions

Based on the information summarized in this document, NMFS has determined that the impact of conducting the seismic survey on the Blanco Fracture Zone in the NPO. will result, at worst, in a temporary modification in behavior, constituting level B harassment, by certain species of marine mammals. This activity is expected to result in no more than a negligible impact on the affected species or stocks.

While the number of potential incidental harassment takes will depend on the distribution and abundance of marine mammals in the vicinity of the survey activity, the number of potential harassment takings is estimated to be small. In addition, the proposed seismic program is not expected to interfere with any subsistence hunts, since seismic operations will not take place in subsistence whaling and sealing areas and will not affect marine mammals used for subsistence purposes.

Authorization

NMFS has issued an IHA to L-DEO to take marine mammals, by harassment, incidental to conducting seismic surveys in the Blanco Fracture Zone, North Pacific Ocean for a 1–year period, provided the mitigation, monitoring, and reporting requirements are undertaken.

Dated: December 7, 2004.

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Acting Director, Office of Protected Resources, National Marine Fisheries Service.

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